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GOVERNMENT OF INDIA

A History of the principal
drugs of vegetables origin
met within British India.
Vol. II
by
William Dymock

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CORRIGENDA.

Page 81, 3rd line from bottom, *for* Deodáil *read* Deodáli.
,, 84, 17th ,, ,, top, *for* lightly *read* slightly.
,, 124, 2nd ,, ,, ,, *for* apigenen *read* apigenin.
,, 130, 16th ,, ,, ,, *for* confectis *read* confectio.
,, 272, 10th ,, ,, ,, Arabic letters [illegible] misplaced.
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OPINIONS OF THE PRESS.

Pharmacographia Indica.

PART II.

We have received Part II. of the "*Pharmacographia Indica,*" which completes the first volume. This portion fully sustains the promise of the previous one, and contains a large quantity of original information relative to Indian Vegetable drugs, as well as carefully collected extracts from the most reliable sources. Under the heading "History, Uses, &c.," the authors have got together some highly instructive notes, which will be useful reading, not only to those interested in drugs and chemicals, but to the general reader likewise.—*Times of India.*

It will be seen that every thing wanting to be known about an Indian drug is made available, and such a book should be in the hands of medical officers and magistrates, both in the chief towns and the Mofussil. There is always a market in England, Germany, and America for Indian drugs of acknowledged merit, and to those who speculate, or experiment with such a commodity we should recommend the "*Pharmacographia Indica*" as a flail to separate the wheat from the chaff.—*Madras Mail.*

Die vorstehenden Mittheilungen aus der *Pharmacographia Indica* bestätigen, dass in dem Werke ein wichtiger Beitrag zur Kenntniss indischer Helpflanzen und Nutzpflanzen geboten wird, welcher der Aufmerksamkeit vieler Kreise in hohem Grade werth ist.—*Pharm. Zeitung.*

The drugs are too numerous to be mentioned in a review of the work, but we are satisfied that we shall frequently have occasion to refer to *Pharmacographia Indica* for reliable information on Indian drugs, and more particularly such which are not, or only to a limited extent, articles of European or American commerce. Part II. is fully equal to Part I. in interest and completeness of information. The work is to be recommended to all interested in Materia Medica, and more particularly that of the East Indies.—*Am. Jour. Pharm.*

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Part II. of this valuable work has recently been put before us. It affords the same evidence of careful study as was exhibited by its predecessor, and it shows that the three joint authors have endeavoured to fill a gap that has long existed. We do not mean merely that such a book as this has long been needed, but that the native pharmacopœia has been too long neglected. . . . The arrangement of the work before us is convenient for easy reference, and it seems certain that the work will be found one of great value to every practitioner in this country. Elsewhere also it might be found extremely useful.—*Madras Times.*

The "*Pharmacographia Indica*" is, however, not valuable merely to those residing in India and to merchants importing Indian drugs, but also to students of materia medica in this country, since the information on a large number of the drugs used in Europe is brought more closely up to date than in almost any other work on Materia Medica. . . . The chemical work that has been done in India, although in many cases not carried to a definite conclusion, consisting rather of proximate analyses, is of great value for future reference, since the exact modes of treating the various drugs, and the solvents used are always stated. The physiological action is in many instances described, and the reputation of the drug among the natives confirmed, or contradicted, as the case may be. There is thus placed before Western nations a repertory of materia medica, replete with valuable, because practical information, from which the searcher for new remedies may cull many promising articles.— . . . Dr. Dymock and his colleagues may be heartily congratulated on having brought to such a pitch of perfection this useful work, which it may confidently be predicted will take as high a place in the pharmaceutical literature of the East as its namesake has in that of the West —*Pharm. Journ., Aug. 9th,* 1890.

In regard to materia medica generally it must always hold a high place as a book of reference. The favourable opinion which we formed on the first part of the volume is enhanced by the uniformly good quality of the matter in this second one. We were at first disposed to think that this was a book which only specialists would have use for; but it grows so interesting, and is so full of valuable information, that we can recommend it to all pharmacists who have a love for books.—*Chemist and Druggist, July 26th,* 1890.

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PHARMACOGRAPHIA INDICA.

COMBRETACEÆ.

TERMINALIA CHEBULA, *Retz.*

Fig.—*Roxb. Cor. Pl., t.* 197; *Bedd. Fl. Sylv. t.* 27; *Gärtn. Fruct.* ii., *t.* 97. Chebulic myrobalan (*Eng.*), Myrobalan Chébule (*Fr.*).

Hab.—India (table lands). The fruit.

Vernacular.—Har, Hara (*Hind.*), Hirada (*Mar.*), Kaduk-kai (*Tam., Mal.*), Hora, Haritaki (*Beng.*), Karakkaya (*Tel.*), Alale-kay (*Can.*), Harade (*Guz.*), Hana (*Pahari*), Silim-kung (*Lepcha*).

History Uses, &c.—There are several varieties of this tree, some of which have probably been produced by cultivation. *T. citrina*, Roxb., is considered by some to be a separate species. Dutt (Hindu Materia Medica) informs us that Chebulic myrobalans, in Sanskrit *Haritaki, Abhaya,* and *Pathyá,* were highly extolled by the ancient Hindus as a powerful alterative and tonic. They have received the names of *Pranada* or life-giver, *Sudha* or nectar, *Bhishakpriya* or Physician's favourite and so forth.* A mythological origin has also been attributed to the tree. "It is said that when Indra was drinking *amrita* in heaven a drop of the fluid fell on the earth and produced the plant." On this account it is called *Shakra-srishtá* "created

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* The following are the synonyms of Haritaki in the Raja-nirghanta:—Har, Sivá, Pathyá, Chetakí, Vijayá, Jayá, Pramatthyá, Pramathá, Amoghá, Káyasthá, Pránadá, Amritá, Jivaniyá, Hemavati, Pútaná, Brantaná, Abhayá, Javasthá, Nandini, Sreyasi, Rohini. In Sankrit prescriptions any one of these names may be used.

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by Indra." Indian writers describe seven varieties of Haritaki, which however are nothing more than the same fruit in different stages of maturity. Very large fruit are considered particularly valuable, and fetch a fancy price. Chebulic myrobalans are considered to be laxative, stomachic, tonic, and alterative. They are prescribed alone or in combination with Emblic and Beleric myrobalans in a vast number of diseases, chiefly those affecting the chest and abdomen. The three myrobalans together are called *triphala* or the *three fruits* in Sanskrit. Various original receipts for their administration will be found in Dutt's Hindu Materia Medica. Myrobalans were known to the early Arabian writers, and through them to the Greek writer Actuarius, who mentions five kinds. Nicolas Myrepsicus also notices them. The author of the Makhzan-el-Adwiya, on the subject of chebulic myrobalans, says that the very young fruit, about the size of cumin seeds, are called *Halileh-i-zira;* when about the size of a grain of barley, *Halileh-i-jawi;* when of the size of a raisin, *Halileh-i-zangi* or *Halileh-i-hindi*; when half arrived at maturity and yellowish, *Halileh-i-chini;* when still further advanced, *Halileh-i-asfar;* and lastly, when quite mature, *Halileh-i-kabuli.* Of these six varieties of chebulic myrobalans, the second, third, and last only are in general use for medicinal purposes, the fourth and fifth, also known as *Rangári har* or *hirade,* are chiefly used by tanners. The Mahometans, like the Hindus, attribute a great many fanciful properties to the drug; shortly, we may say, that the ripe fruit is chiefly used as a purgative, and is considered to remove bile, phlegm, and adust bile; it should be combined with aromatics, such as fennel seeds, caraways, &c. The Arabs say,—"*Ihlilaj* is in the stomach like an intelligent housewife, who is a good manager of the house." The unripe fruit (*Halileh-i-hindi* or *Himaja*) is most valued on account of its astringent and aperient properties, and is a useful medicine in dysentery and diarrhœa; it should also be given with aromatics. Locally it is applied as an astringent. The first and second kind are supposed to have the same properties as the third in a less degree, and the fourth and fifth the same as the sixth in

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a less degree. The best way of administering myrobalans as a purgative is to make an infusion or decoction of from 2 to 4 drachms of fruit pulp with the addition of a pinch of caraway seeds and a little honey or sugar.

Ainslie notices their use as an application to aphthæ. In the *Pharmacopœia of India*, Dr. Waring mentions his having found six of the mature fruit an efficient and safe purgative, producing four or five copious stools, unattended by griping, nausea or other ill effects; probably those used by him were not of the largest kind. Dr. Hové in his account of a visit to the Myrobalan Plantation at Bungar in the Concan in 1787, states that he found one fruit a sufficient purgative, though the manager of the plantation told him that two were generally used. Twining (*Diseases of Bengal*, Vol. I., p. 407,) speaks very favourably of the immature fruit (*Halileh-i-zangi*) as a tonic and aperient in enlargements of the abdominal viscera. We have found them a useful medicine in diarrhœa and dysentery, given in doses of a drachm twice a day. Recently, *M.* P. Apéry has brought to the notice of the profession in Europe the value of these black myrobalans in dysentery, choleraic diarrhœa, and chronic diarrhœa; he administers them in pills of 25 centigrams each, the dose being from 4 to 12 pills or even more in the 24 hours. (*Journ. de Pharm. et de Chim.* Feb. 1st, 1888.) Roxburgh states that the tender leaves, while scarce unfolded, are said to be punctured by an an insect, and its eggs deposited therein, which by the extravasation of the sap, become enlarged into hollow galls of various shapes and sizes, but rarely exceeding an inch in diameter. They are powerfully astringent, and make as good ink as oak galls. They also yield the chintz painters on the coast of Coromandel their best and most durable yellow. They are called by the Tamils *Kadu-cai-pu*, and by the Telingas *Aldicai*, (*Fl. Ind.* II., 435.) In the *Pharmacopœia of India* they are noticed on the authority of the Rev. J. Kearns of Tinnevelly as a valuable astringent in diarrhœa. The Himalayan tribes eat the kernels of this myrobalan, and use the fruit as a remedy for sore throat under the name of *Khoki*.

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Description—The mature myrobalan is of on ovoid form, from 1—1½ inches long, sometimes tapering towards the lower extremity, obscurely 5 or 6-sided, more or less furrowed longitudinally, covered with a smooth yellowish brown epidermis, within which is an astringent pulp, enclosing a large rough bony, one-celled endocarp.

The unripe fruits are shrivelled, black, ovoid, brittle bodies, from ⅓ to ¾ of an inch in length, having a shining fracture and an astringent taste; on careful examination the rudiments of the nut may be distinguished.

Chemical composition.—According to Stenhouse (1843), chebulic myrobalans contain about 45 per cent. tannin, also gallic acid, mucilage and a brownish yellow colouring matter. Hummel has obtained 31 per cent. of tannic acid, and Paul 32·82, and 26·81 of gallotannic acid from two ordinary samples of the commercial article, but from a sample of inferior quality only 6·11 per cent.

Herr Fridolin (1884) reported to the Dorpat Naturforscher Gesellschaft the isolation from chebulic myrobalans of a new organic acid, which he has named *chebulinic acid*, and considers to be probably the source of the gallic and tannic acids detected by previous observers. He obtains it by saturating an aqueous solution of an alcoholic extract of the fruit with sodium chloride, dissolving the matter that separates in water, and shaking the solution with acetic ether, which takes up the chebulinic acid together with tannic acid. The residue after the evaporation of the ether is dissolved in a little water and allowed to stand for a few days, when the chebulinic acid crystallizes out in rhombic prisms. The acid, which is odourless and sweet, dissolves very readily in alcohol and hot water, not so freely in ether, and with great difficulty in cold water, the solutions having an acid reaction. In aqueous solution the chebulinic acid reduces Fehling's solution, and in some of its reactions it closely resembles gallic acid, but differs from it in affording no colour reaction with potassium cyanide. Herr Fridolin suggests as a formula probably representing its composition, $C^{28} H^{24} O^{19}$. ($C^{7} H^{6} O^{5}$?) When decomposed

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by heating an aqueous solution in a closed tube, chebulinic acid takes up the elements of water, and the molecule is split up into two molecules of gallic acid and one of tannic acid. Herr Fridolin suggests the possibility of the existence in other instances of an organic compound splitting up into tannic and gallic acids.

According to *M.* P. Apéry, black myrobalans contain an oleo-resin of a green colour soluble in alcohol, ether, petroleum spirit and oil of turpentine; this oleo-resin, which has been named by him *myrobalanin*, is coloured red by nitric acid. (*Journ. de Pharm. et de Chim.*, Feb. 1st, 1888.)

Commerce.—See next article. Very large chebulic myrobalans are sold in the bazars as Sarvári or Sardári har, and often fetch a rupee each. Fictitious myrobalans of very large size are manufactured by glueing slices of the pulp upon a natural fruit.

TERMINALIA BELERICA, *Roxb.*

Fig.—*Bedd. Fl. Sylv., t.* 19; *Wight Ic., t.* 91; *Rheede Hort. Mal. iv., t.* 10. Beleric myrobalan (*Eng.*), Myrobalan beléric (*Fr.*).

Hab.—India.

Vernacular.—Bahera, Bharla, Balra (*Hind.*), Bahera, Bohora (*Beng.*), Behada, Vahela (*Mar.*), Tánrik-kay, Thani (*Tam.*), Tándra-káya (*Tel.*), Tári-káyi (*Can.*).

History, Uses, &c.—This tree, in Sanskrit Vibhita and Vibhitaka (fearless), is avoided by the Hindus of Northern India, who will not sit in its shade, as it is supposed to be inhabited by demons. Two varieties of *T. belerica* are found in India, one with nearly globular fruit. ½ to ¾ inch in diameter, the other with ovate and much larger fruit. The pulp of the fruit (Beleric myrobalan) is considered by Hindu physicians to be astringent and laxative, and is prescribed with salt and long pepper in affections of the throat and chest. As a constituent of the *triphala* (three fruits), *i.e.*, emblic, beleric and chebulic

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myrobalans, it is employed in a great number of diseases, and the kernel is sometimes used as an external application to inflamed parts. On account of its medicinal properties the tree bears the Sanskrit synonym of Anila-ghnaka, or "wind-killing." According to the Nighantás the kernels are narcotic. Mahometan writers describe Balilaj (the beleric myrobalan) as astringent, tonic, digestive, attenuant, and aperient, and useful as an astringent application to the eyes. As long as the doctrines of the Arabian school prevailed, myrobalans were used medicinally in Europe, having been introduced by the Arabs from India. The μυροβαλανος of the classical Greek and Latin writers was a fruit from which the perfumers obtained oil for their unguents. According to Theophrastus, the outer cortical portion was pounded to extract the oil, as that part only was sweet smelling. It is uncertain what this fruit was, but it appears to have been something similar to that of the African oil palm (*Elæis guineensis*), the outer fleshy coating of which yields an oil of the consistence of butter, having a rather pleasant violet-like odour when fresh. The later Greek physicians apply the terms μυροβαλανος and μυρεψικος to Indian myrobalans.

T. belerica produces a quantity of gum of the Bassora type, which is collected and mixed with soluble gums for sale as country gum.

Description.—The fruit of the smaller variety of this myrobalan is nearly globular, and suddenly narrowed into a short stalk, it is from $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, fleshy, covered with a close fulvous tomentum; the stone is hard and pentagonal, and contains a sweet oily kernel, having three prominent ridges from base to apex. In the larger variety the fruit is ovoid and about double the size, and the flowers have a powerful stercoraceous odour exactly resembling that of the wood of *Celtis reticulosa* in which W. A. Dunstan has demonstrated the presence of skatole. The gum is mostly in vermicular pieces of a yellowish-brown colour; in water it forms a bulky gelatinous mass of insipid taste.

Chemical composition.—The percentage of tannic acid in these myrobalans appears to vary considerably. Hummel ob-

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tained 17·4 per cent.; he remarks that the fruit consists of two distinct portions, an outer and inner; 100 parts contains 75·4 per cent. outer, and 24·6 per cent. inner. The inner portion only contains 1·25 per cent. of tannic acid. Paul obtained from two commercial samples of beleric myrobalans 5·03 and 6·70 of gallotannic acid. (*Watt., Selections from the Records of the Govt. of India*, Vol. I., pp. 38 and 93.) We have examined the pulp of the smaller myrobalan removed from the shell enclosing the kernel, and the kernels separately, with the following results:—

	Pulp.	Kernel.	
Moisture	8·00	11·38	per cent.
Ash	4·28	4·38	,,
Petroleum ether extract ...	·12	29·82	,,
Ether extract	·41	·61	,,
Alcoholic ,, ...	6·42	·61	,,
Aqueous ,, ...	38·56	25·26	,,

Pulp.—The moisture was determined by heating to 100° C. the finely powdered material. The ash contained no manganese.

The petroleum ether extract consisted of greenish yellow oil.

The ethereal extract contained colouring mattter, resins, a trace of gallic acid, and oil. No alkaloid was present.

The alcoholic extract was yellow, brittle, and highly astringent. In warm water it was partly soluble. The aqueous solution gave the following tannin reactions: with ferric chloride indigo-blue, changing to damson on the addition of ammonia; with lime water a light yellow precipitate, turning greenish blue on adding an excess; with bichromate of potash a dirty reddish brown precipitate; with bromine water no precipitate; with sulphate of copper a slight precipitate; on adding ammonia a dense nearly white precipitate, rapidly becoming yellow and then yellowish brown. No alkaloidal principle was detected.

Kernels.—The moisture was determined first by exposure over sulphuric acid in a vacuum: and then at 100° C. The ash contained no manganese.

The petroleum ether extract consisted of a pale yellow, thin, nutty flavoured oil, non-drying, and insoluble in alcohol; on

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standing no crystalline deposit was formed; there was nothing specially noteworthy regarding its colour reactions. No alkaloidal principle was detected. The ethereal extract was whitish and oily; in light petroleum ether ·52 per cent. was soluble, which added to the petroleum ether extract, would increase the oil content of the kernels to 30·44 per cent.; the residue insoluble in light petroleum ether amounted to ·09 per cent., and did not afford reactions for alkaloidal principles. Brannt states that the oil behaves in the same manner as mastic oil when obtained by expression, and he describes it as a green fluid oil, from which a white fat of the consistence of butter separates.

The alcoholic extract was whitish and partly soluble in hot water with acid reaction, tasteless; no alkaloid was detected.

The aqueous extract did not reduce an alkaline copper solution until after boiling with a dilute acid. The extract was specially examined for saponin with negative results.

The powdered air-dried bark of the large variety of *T. belerica* contained 3·71 per cent of moisture, and 18·61 per cent of ash, in which no trace of manganese could be detected.

With the exception of astringent matter, giving a brownish coloration with ferric salts, nothing of special importance was detected in either the bark or leaves—no alkaloids or glucosides were detected. An alcoholic extract, after separation of the alcohol, obtained from 10 grams of the bark injected into a cat's stomach, afforded the following symptoms:—

Injected at 10-50 a. m. into a cat's stomach which had fasted for about 10 hours.

11-15. Vomited twice.
11-25. Solid motion.
11-45. Vomited.

No further symptoms were noted, and the following day the cat appeared to be in its normal condition.

In the case of the leaves an alcoholic extract induced almost immediate vomiting without any other symptoms.

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In neither of the experiments was there heaviness, inability to move, or any symptoms of intoxication noticed.

Toxicology.—Roxburgh and Graham notice the popular belief that certain trees of *T. belerica* bear fruit the kernels of which have intoxicating properties; these trees are said by some to be always those of the large fruited variety. Native evidence on this point is conflicting, some people say that they have eaten both kinds of the seeds freely without experiencing any narcotic effects, but that when water is taken after eating them giddiness and a sense of intoxication is experienced. If vomiting occurs these symptoms soon pass off. There is no doubt that children often spend many hours under these trees eating the seeds, and it is quite possible that severe attacks of indigestion may follow such excesses.

The only cases of poisoning by the Bahira have been recorded by Mr. Raddock, Sub-Assistant Surgeon in charge of the Malwa Bheel Corps. Three boys, from five to nine years of age, picked up and ate some of the dry nuts near the house of a Chamar, who had brought them from the jungles for the purpose of colouring leather. Two of these boys, became drowsy, complained of headache and sickness at stomach, and vomited freely a thick white frothy mucus The third, a rather weakly boy of seven, was first seen by Mr. Raddock on the following morning. He was in his father's lap, and appeared as if asleep; the legs and arms were relaxed and bent; eyes closed, breathing soft. There was total insensibility; and shaking and calling did not make him stir in the least, or answer. The pulse was scarcely perceptible, action of the heart frequent and weak. Body of natural warmth, legs cold, eyes rather glistening, pupils fixed, neither contracted nor dilated, jaws closed, and only to be opened by much force. This child had eaten the largest quantity of kernels—between 20 and 30. At the time, or subsequently, nothing was complained of. He played all day and at night before going to bed; went to sleep, and was not noticed until next morning, when he was found insensible, and was supposed to be dead. With difficulty he was made to vomit

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three or four times, the eyes opened with a heavy dull expression, and closed again; though he relapsed his condition was now improved, the insensibility was not so deep, and his hand was moved to his throat. Small quantities of strong black tea were administered. About 10 a. m. he became sensible, opened his eyes, and answered, when spoken to; towards the afternoon he walked about and improved greatly. At 5 in the evening he was sensible but drowsy, pulse small and rapid, complained of being giddy, had vomited twice since morning, with relief to the symptoms. His recovery was speedy. Mr. Raddock justly infers from these cases that the Bahira is a mild narcotic poison. In the last mentioned case he is convinced that it would have proved fatal had the stomach-pump not been used, or had emetics failed. He adds that, in two of the boys who ate about the same quantity, no effects were produced till about eight hours after, and the poison was got rid of by vomiting. In the third, who ate the most, no effects were produced in 12 hours; at least no vomiting resulted, and during sleep, insensibility came on.

Dr. Burton Brown in citing this case says that *Terminalia belerica* is sometimes added to spirit in bazaars, in conjunction with the Chebulic myrobalan (*hara*) and the Emblic myrobalan (*avola*), so that it is possible that an accident might occur from the use of spirit so drugged.

Royle and Birdwood merely say that the seeds of the *Terminalia bêlerica* are eaten as nuts. O'Shaughnessy, however, adds that they "are deemed intoxicating." (*Chevers.*)

As regards the seeds eaten in moderation, our experiments lead to the conclusion that they are perfectly harmless; one of us has eaten kernels without any ill effects. In one of our experiments we injected into a cat's stomach an alcoholic extract from 9 grams of the kernels with negative results. In another experiment we mixed 13·2 grams of kernels, equal to about 35—40 kernels, reduced to a fine pulp, with about 30 grams of raw meat, also pulped: this mixture was readily eaten at 11·5 a. m. by a cat which had been fasting for many hours:

when the laboratory was closed at 4 p. m. the cat appeared in its usual condition, no symptoms having been induced, and on the following morning it appeared to be perfectly well. We learn that Jogis consider that one kernel eaten daily increases the appetite for sexual indulgence. Our experiments appear to be fairly conclusive that these kernels do not possess any toxic properties.

Commerce.—Myrobalans are one of the principal forest products of India; they are collected in large quantities on Government account, and yearly auctions are held by the Forest Conservancy Department. Both chebulic and beleric myrobalans are largely exported for tanning and dyeing. The exports from the whole of India were:—In 1885-86, 706,000 cwts., valued at 30 lakhs of rupees; in 1886-87, 597,000 cwts., valued at 23 lakhs of rupees; in 1887-88, 678,000 cwts., valued at 25 lakhs of rupees.

TERMINALIA ARJUNA, *Bedd.*

Fig.—*Fl. Syl., t.* 28; *D C. Mem. Combr. t.* 2.

Hab.—Deccan, Ceylon, North-West Provinces. The bark.

Vernacular.—Kahu, Arjun (*Hind.*), Vellai-maruda-maram (*Tam.*), Tella-maddi-chettu (*Tel.*), Arjun, Shárdul, Pinjal (*Mar.*), Arjun (*Beng.*), Tora-billi-matti (*Can.*).

History, Uses, &c.—This tree is the Arjuna and Kukubha of Chakradatta, who describes it as tonic, astringent, and cooling, and prescribes it in heart disease and for those purposes for which astringents are generally applied. He recommends it to be given in milk, treacle or water when used internally, or as a *ghrita* (medicinal butter) made with the decoction and powder of the bark.

Hindu physicians think that the bark has some special virtue in promoting the union of fractures, and the dispersion of ecchymosis when given internally. It is considered to be *Asmari-hara*, or lithontriptic, and a reference to the chemical composition will show that the ash of the bark contains an

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extraordinarily large proportion of calcium carbonate. Externally it is used in the form of an astringent wash to ulcers.

Description.—The bark is generally sold in short half quills, frcm $\frac{1}{8}$ to $\frac{2}{8}$ of an inch thick, and several inches long; it has a pinkish colour, which is seen through the thin grey epidermis; its substance is fibrous and gritty under the teeth; it breaks with a short fracture, the internal surface being of a lighter colour and finely striated. The taste is agreeably astringent. The bark when magnified shows remarkably large cells in the medullary rays, and numerous large stone cells of a bright yellow colour contrast strikingly with the pinkish tinge of the other structures. It contains much crystalline matter.

Chemical composition.—This is most remarkable, the ash amounts to 34 per cent. of almost pure calcium carbonate, which if calculated into oxalate would amount to 43·5 per cent. The watery extract is 23 per cent. with 16 per cent. of tannin; very little colouring matter besides the tannin is extracted by alcohol. The tannin gave a blue-black precipitate with ferric salts.

ANOGEISSUS LATIFOLIA, *Wall.*

Fig.—*Bedd. Fl. Sylv.*, *t.* 15; *Royle Ill.*, *t.* 45; *Wight Ic.*, *t.* 994.

Hab.—Himalayas to Ceylon. The gum and leaves.

Syn.—*Conocarpus latifolia.*

Vernacular.—Dháoya, Dhaura, Dhava, Bakla (*Hind.*), Davda (*Guz.*, *Mar.*), Vallai-naga, Vakkali (*Tam.*), Chiriman, Yellamaddi (*Tel.*), Dinduga (*Can.*).

History, Uses, &c.—A large and very common tree called in Sanskrit Dhava, Dhavala, Madhura-tvacha and Vakavriksha, or "crane tree," on account of the resemblance of its fruit to the head of a crane (vaka). The wood is hard but not durable; it affords a good fuel and excellent charcoal. The tree is remarkable for the large amount of gum which

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flows from it, whence the Sanskrit name Dhava, from धव, to flow. The gum has a great reputation in India among calico-printers for use with certain dye-stuffs, such as turmeric. The leaves are used in most parts of the country for tanning.

Description.—Leaves short petioled, ovate, generally emarginate, entire, smooth, from one to four inches long, and from one and a half to two broad. Taste very astringent. In the variety *villosa* the leaves are rusty villose on both surfaces, and in the variety *parvifolia* they are very small and silky pubescent. For a description of the gum the reader is referred to the article upon the *Substitutes for Gum Acacia*, Vol. I., p. 544.

Chemical composition.—The leaves have been examined by Hummel, who obtained from them a pale yellow decoction, and 15·5 per cent. of tannic acid. (*Watt, Selections from the Records of the Govt. of India* Vol. I., p. 93.) Lyon, who has also examined them, obtained a similar result.

QUISQUALIS INDICA, *Linn.*

Fig.—*Lam. Ill., t.* 357; *Wight Ill., t.* 92; *Bot. Reg. N. S. XXX., t* 15. Rangoon creeper (*Eng.*), Liane vermifuge (*Fr.*).

Hab.—Malaya. India, cultivated. The seeds.

Vernacular.—Rangun-ki-bel(*Hind.*),Vilayati-chameli(*Mar.*), Irangun-malli (*Tam.*), Rangunu-malle-chettu (*Tel.*).

History, Uses, &c.—In the Moluccas the seeds have long been held in repute as an anthelmintic, and in 1833 they were brought forward by Dr. Oxley and Mr. Gordon of Singapore. (*Calcutta Med. and Phys. Trans.*, vii., p. 488.) The testimony adduced in their favour by these authorities is strong, and is to the effect that in cases of *lumbrici*, four or five of these seeds, bruised and given in electuary with honey or jam, suffice for the expulsion of the entozoa in children. Bouton (*Med. Plants of Mauritius*, p. 58), who gives *Liane vermifuge*

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as the name of the shrub in the Mauritius, states that if more than four or five seeds are given they are apt, in some constitutions, to cause spasm and other ill effects. (*Pharm. of India.*) Loureiro states that the leaves are astringent. This plant is cultivated as a flowering shrub in most parts of India, but except in the Southern Provinces it very seldom ripens its fruit, and its medicinal properties are consequently unknown in most parts of the country.

Description.—The fruits are about an inch in length, oval or oblong, pointed at either extremity, and sharply pentagonal; they dehisce from the apex. The woody pericarp is thin, fragile and of a deep mahogany colour; it encloses a pentagonal seed nearly black when dry, yellowish and oily internally. (*Fig. in Hanbury's Science Papers, p.* 232.)

Chemical composition.—Quisqualis fruits consist of 41 parts shells and 59 parts kernels in 100 parts. The fixed oil obtained by ether amounts to 15 per cent.; it is of a yellow colour, peculiar odour, and has a specific gravity of ·9169. It yields on saponification 94·7 per cent. of fatty acids melting at 43° C. The oil with sulphuric acid passes from a reddish-brown colour through red and green to purple. The alcoholic extract, after removal of the oil, is intensely sweet owing to the presence of an amorphous fermentable sugar similar to levulose; the solution in water acidified with acetic acid and shaken with ether affords on evaporation of the ether a crystalline residue, soluble in sulphuric acid without colour, striking an orange colour with caustic soda, and giving in watery solution precipitates with the alkaloidal reagents. The drug now treated with water yields a deep reddish brown colouring matter of the nature of an organic acid. It darkens slightly with iron salts, gives no precipitate with gelatine, and is wholly removed from solution by neutral plumbic acetate, and the precipitate after standing some days remains in an amorphous condition. This aqueous extract was rendered turbid by alcohol, mineral acids and tannin solution, and decomposed when evaporated. The behaviour of the extract points to the

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presence of cathartic acid, or an analogous acid of the amidic series. The seeds afford 7 per cent. of an alkaline deliquescent ash.

CALYCOPTERIS FLORIBUNDA, *Lam.*

Fig.—*Roxb. Cor. Pl., t.* 87.

Hab.—Western India, Assam. The leaves, root, and fruit.

Vernacular.—Bandi-murududu (*Tel.*), Báguli, Ukshi (*Mar.*), Kokoranj, (*Hind.*), Marsada, Báguli (*Can.*).

History, Uses, &c.—This is a dense climbing shrub. The Marathi name Ukshi is evidently derived from the Sanskrit उक्ष, to sprinkle or moisten, as plants loving shade and moisture, such as *Naregamia alata*, flourish beneath it. The leaves are bitter and astringent, and are chewed by the natives and the juice swallowed as a remedy for colic. The root ground to a paste with that of *Croton oblongifolium* is applied to bites of the Phoorsa snake (*Echis carinata*). In *panduroq* (jaundice) ukshi fruit and various spices, of each one part, are made into a compound powder, of which the dose is two massas.

The fruit, with the root of *Grewia pilosa*, Lam., is rubbed into a paste with honey and applied to ulcers.

Description.—Leaves opposite, shortly petioled, elliptic or ovate, acuminate, entire. On the upper surface are thinly scattered long hairs which are most abundant at the edges; the under surface is rusty tomentose, the tomentum being collected in little tufts giving rise to a dotted appearance in the fully mature leaf; taste very astringent and somewhat bitter. The fruit is about ¼ inch in length, ovoid, 5-ribbed, villous, 1-seeded, and is surmounted by the enlarged calyx; cotyledons convolute.

Chemical composition.—The leaves assayed by Löwenthal's permanganate and gelatine process yield 6·86 per cent. of tannin, expressed in terms of gallo-tannic acid using Neubauer's equivalent.

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The plants of minor importance belonging to this Order, which are sometimes used medicinally, are:—

Terminalia tomentosa, *Bedd. Fl. Sylv.*, t. 17, and its variety, *T. glabra, Vern.*—Asan (*Hind.*), Ain (*Mar.*), Kurrupu-maruta-maram (*Tam.*), Piasal (*Beng.*), Nalla-maddi-chettu (*Tel.*), Tembavu (*Mal.*), trees common in most parts of India, have an astringent bark which is used for tanning, and has been recommended for medicinal use by Dr. Æ. Ross. Powdered and mixed with oil it is used for aphthæ. The ash of the bark contains much potash and is eaten by the natives, and the leaves are used for manuring rice fields. (*Bourdillon.*) Paul found 5·97 per cent. of tannin in the bark, and Hummel 4·0 per cent. We find that the bark of the variety *glabra* contains moisture 9·59, ash 14·94, and tannin 7·2 per cent. The alcoholic extract contained 13·9 per cent. of tannin and colouring matters precipitated by lead. The tannin gave a blue-black precipitate with ferric salts.

The flowers of **Terminalia paniculata**, *Roth.*, *Bedd. Fl. Sylv.*, *t.* 20, Maruthu (*Tam.*, *Mal.*), a tree of Malabar, the Nilgiris and Coorg, are used medicinally by the country people, pounded with the root of *Cissampelos Pareira*, as a remedy in cholera. The juice of the flowers along with that of Guava bark is administered as an antidote in poisoning by opium. If the flowers are not obtainable the bark may be used. The juice of the flowers or bark, with melted butter and rock salt, is applied externally in parotitis. The Marathi name for this tree is *Kinjal*, the Tamils call it *Maruthu* and *Vella-maruthu* or *Ola-maruthu*.

Terminalia Catappa, *Linn.*, *Bot. Mag.* 3004; *Bedd. Fl. Sylv.*, t. 18, the *Catappa* of the Malays, is now cultivated all over India, and is known as the almond tree (*Badam*) to both natives and Europeans. The fruit is an oval, compressed, smooth drupe, with two elevated grooved margins; it is about 2 inches long and of a dull purple colour when ripe, the pulp being bright purple. The nut is rough, hard and thick, and

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the kernel which is about half the size of an almond and nearly cylindrical, is in common use in Bengal, amongst Europeans under the name of "leaf nut." According to Braunt the almonds contain 28 per cent. of oil, which excels almond oil as regards flavour and mildness, and has the further advantage of keeping well. It is of a pale yellowish colour and entirely inodorous. Its specific gravity is 918 at 15° C., and it is composed chiefly of stearin and olein, the stearin separating at 5° C. The bark is astringent, and has been recommended for internal administration in the form of decoction as a remedy for gonorrhœa and leucorrhœa. (*Pharm. de St. Domingue.*) The tree yields a gum of the Bassora type.

MYRTACEÆ.

BARRINGTONIA ACUTANGULA, *Gärtn.*

Fig.—*Bedd. Fl. Sylv.*, *t.* 204. The fruit, *Gärtn. Fruct.* ii. 97, *t.* 101.

Hab.—Throughout India. The seeds.

Vernacular.—Hijjal, Samandar-phal (*Hind.*, *Beng.*), Samudar-phal (*Guz.*), Samutra-pullam, Kadapum (*Tam.*), Kadamik, Kanapa (*Tel.*), Pivar, Sáthphal, Dhátriphal, Ingli (*Mar.*, *Can.*).

History, Uses, &c.—This is an evergreen tree of moderate size, called by Sanskrit writers Hijja or Hijjala. The fruit is spoken of as Samudra-phala and Dhátriphala or "nurse's fruit," and is one of the best known domestic remedies. When children suffer from a cold in the chest, the seed is rubbed down on a stone with water and applied over the sternum, and if there is much dyspnœa a few grains with or without the juice of fresh ginger are administered internally and seldom fail to induce vomiting and the expulsion of mucus from the air passages. To reduce the enlarged abdomen of children it

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is given in doses of from 2 to 3 grains in milk. Rumphius states that the roots are used to kill fish, and this use of the bark is known in most parts of India. The fish are said to be not unwholesome.

B. racemosa, *Blume*, has similar properties, the bark, root and seed being bitter. Ainslie states that in Java and in Ternate the seeds are used for intoxicating fish. The powdered seeds of these plants induces sneezing.

Description.—The dry seeds as met with in the shops resemble a nutmeg in size and shape; externally they are somewhat rough, brown, and marked with longitudinal striæ; internally horny, hard and brittle when dry, but easily softened by immersion in water; the bulk of the seed consists of starch. Taste sweet at first, afterwards bitter and nauseous.

Chemical composition.—The active principle of these seeds appears to reside in a body allied to saponin. The aqueous solution forms a stable froth when shaken, and tastes at first sweet and afterwards bitter and acrid. This solution precipitated with barium hydrate, the precipitate collected, dissolved in hydrochloric acid, the barium removed as sulphate, and the clear liquor boiled, threw out an insoluble substance related to sapogenin, and the filtrate gave the reactions for glucose. The aqueous extract gave an immediate precipitate of a proteid nature with acids, which, dissolving to some extent when heated and separating again in the cold, resembled albumose; after removal of this proteid, the acid liquor was boiled, and the formation of a flocculent deposit and an increase in the amount of glucose were noticed, which confirmed the presence of a glucosidal body such as saponin. Rectified spirit dissolved 24 per cent. of extract containing gallic acid, sugar and some saponin; and the subsequent treatment with water removed more saponin together with gum and proteids. The remaining principles that could be identified were a fat, caoutchouc, a very large quantity of starch and cellulose, the ash consisting of alkaline and deliquescent salts.

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CAREYA ARBOREA, *Roxb.*

Fig.—*Roxb. Cor. Pl. iii.*, 14, *t.* 218; *Wight Ill.*, 99, 100; *Bedd. Fl. Sylv.*, *t.* 205. Pera brava (*Port.*), Wild Guava (*Eng.*).

Hab.—Throughout India.

Vernacular.—Kumbhi (*Hind.*, *Beng.*), Kumbha (*Mar.*, *Guz.*), Putai-tanni-maram, Arjama (*Tam.*), Kumbhia, Gonju (*Can.*), Kumbhi, Dudippi, Gavuldu (*Tel.*), Peru (*Mal.*). The dried calices, Vákumbha (*Guz.*), Bakumbha (*Beng.*).

History, Uses, &c.—*C. arborea* is a large deciduous tree, the leaves of which turn red in the cold season. It is the Kumbhi of Sanskrit writers, and appears to have been so named on account of the hollow on the top of the fruit giving it somewhat the appearance of a water-pot. The bark of the tree and the calices of the flowers are well known Indian remedies, and are valued on account of their astringent and mucilaginous properties, being administered internally in coughs and colds and applied externally as an embrocation. Rheede (*Hort. Mal. iii.*, 36,) states that wild pigs are very fond of the bark, and that it is used by hunters to attract them. An astringent gum exudes from the fruit and stem, and the bark is made into coarse cordage. (*Bourdillon.*) The Tamil name Puta-tanni-maram signifies "water-bark-tree," in allusion to the exudation trickling down the bark in dry weather.

Description.—Calyx ¾ to 1 inch, terete, campanulate, obscurely pubescent, lobes ovate, obtuse, ovules in two rows in each cell of the ovary. Fruit 2½ by 2 inches, globose, surmounted by an enlarged mouth having a depressed pit at the vertex within the calyx teeth. Bark thick, fibrous, externally ash-coloured, internally reddish when dry, the whole plant abounds with thick mucilage.

Chemical composition.—The thick red bark from old trees contained 8·7 per cent. of tannin, giving a blue-black colour with iron salts and containing 29 per cent of Pb O in its lead salt. The tannin was in a free state. The bark left 10·6 per cent. of carbonated ash from the reduced calcium oxalate which occurred in large simple crystals in the liber.

CARYOPHYLLUS AROMATICUS, *Linn.*

Fig.—*Bentl. and Trim.*, t. 112. Clove tree (*Eng.*), Girofflier aromatique (*Fr.*).

Hab.—Moluccas, cultivated elsewhere. The flower buds and fruit.

Vernacular.—Laung (*Hind.*), Lavanga (*Mar., Can.*), Long (*Beng.*), Lavang (*Guz.*), Lavangálu, Lavanga-pu (*Tel.*), Kirámbu, Ilavangap-pu, Karuvap-pu (*Tam.*). The fruit, Narlaung (*Ind. Bazar*).

History, Uses, &c.—The clove tree is said to be indigenous only in the five small islands, which constitute the Moluccas proper, *viz.*, Tarnati, Tidori, Mortir, Makiyan and Bachian. It was afterwards introduced into other neighbouring islands, where it is now cultivated, and at a later period into Zanzibar and Pemba on the East coast of Africa. Cloves appear to have been known in China as early as B.C 266. At that time it was customary for the officers of the court to hold the spice in the mouth before addressing the sovereign in order that their breath might have an agreeable odour. (*Pharmacographia.*) It is difficult to say when they were first introduced into India, but they are mentioned by Charaka, who is considered to be the oldest Sanskrit medical writer, under the name of *Lavanga*, a name which, with various modifications, is applied to cloves all over India. They are regarded by Sanskrit writers as light, cooling, stomachic, digestive and useful in thirst, vomiting, flatulence, colic, &c., and are prescribed with other spices and with rock salt. (*Dutt's Hindu Materia Medica.*) A paste of cloves is applied to the forehead and nose

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as a remedy for colds. A clove roasted in the flame of a lamp and held in the mouth is a popular remedy for sore throat. The early Arabian writers call them Karanfal, a name evidently derived from the Indian languages of the Malabar Coast, Ceylon, and the Straits*; this name appears to us to have been the source from whence the Greeks have derived the name καρυοφυλλον which we meet with in Galen and Pliny; the latter writer speaks of Caryophyllon as resembling pepper but longer and more brittle and imported for the sake of its odour. We do not think it possible that a spice in such common use in the East can have escaped their notice. Paulus describes cloves as the flowers of a tree, and καρφιοειδη (like a nail). Myrepsicus in a prescription calls mother cloves γαρεόφαλον το μέγα το λεγόμενον παρ̀ 'Ιταλοις ἀνθοφυλον. In the debased Greek of the later Greek physicians, the name takes various forms more nearly corresponding to the Arabic. Later Arabian and Persian authors of treatises on Materia Medica describe cloves as the fruit of a tree growing in Java or Batavia, a territory belonging to the Dutch Christians. In the *Makhzan-el-Adwiya*, a work written about one hundred years ago, it is distinctly stated that they are only produced in the Dutch possessions, and that they are of two kinds, male and female. The fruit of the clove is called Narlaung (male clove) in India, a strange mistake but a common one among Asiatics, who argue that the seed-bearing organ or plant must be the male. Mahometan writers describe cloves as hot and dry, and consider them to be alexipharmic and cephalic, whether taken internally or applied externally; they also recommend them for strengthening the gums and perfuming the breath, and on account of their pectoral, cardiacal, tonic, and digestive qualities. They have a curious superstition to the effect that one male clove eaten daily will prevent conception. On the other hand, they tell us that the saliva after cloves have been chewed, if applied to the orifice of the male urethra before connection, increases the sexual orgasm in both parties. In modern medicine cloves are used as a

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* Kirámbu, *Tamil;* Karámpu, *Malay;* Karámbu, *Cingalese.*

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carminative and stimulant; to relieve irritation of the throat accompanied by racking cough, and to deaden the pain of toothache.

Description.—The flowers of the Clove grow in cymes, when fit for gathering the calyx tube is of a bright red colour, and the tree presents a very beautiful appearance. The collection as witnessed by one of us at Zanzibar is by hand, each clove being picked singly. They are afterwards dried upon mats in the sun, which takes abont three days. The dried clove is about two-thirds of an inch long, and consists of the calyx-tube, which divides above into four pointed spreading sepals, surmounted by a globular bud, consisting of 4 petals and enclosing a number of stamens. All parts of the clove abound in oil cells. If of good quality it should be plump, of a rich brown colour, and the oil should exude upon pressure being made with the finger nail; the taste should be aromatic and very pungent.

Mother cloves, called in India *Narlaung* (male cloves), are ovate-oblong berries about an inch long, and contain two dark-brown oblong cotyledons which abound in starch; they have the odour of cloves, but contain much less essential oil.

Clove stalks, in Guzerathi *Vikunia,* are only brought to India for re-export to Europe.

The *oil of cloves* of the Indian bazars is made by steeping cloves in sweet oil. No essential oil is manufactured in the country.

Chemical composition.—Oleum Caryophylli, which is the most important constituent of cloves, is obtainable to the extent of 16 to 20 per cent. But to extract the whole, the distillation must be long continued, the water being returned to the same material.

The oil is a colourless or yellowish liquid with a powerful odour and taste of cloves; sp. gr. 1·046 to 1·058. It is a mixture of a terpene and an oxygenated oil called *Eugenol,* in variable

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proportions. According to Schimmel & Co., the genuine oil of cloves has a specific gravity of 1·067, and the oil of clove stalks a specific gravity of 1·060 to 1·063. The former, which is termed *light oil of cloves,* and comes over in the first period of the distillation, has the composition $C^{15}H^{24}$, a specific gravity of 0·918, and boils at 254° C. Vapour density 7·7. It deviates the plane of polarization slightly to the left, and is not coloured on the addition of ferric chloride; it is converted by Br into $C^{15}H^{22}$ (250°—260°). (*Beckett and Wright Journ. Chem. Soc.* 29, 1.) Eugenol has a specific gravity of about 1·080 at 0° C., and possesses the taste and odour of cloves. Its boiling point is 252° (*Church*), vapour density 6·4. Eugenol, $C^{10}H^{12}O^{2}$, is devoid of rotatory power, it belongs to the phenol class, and has been met with in the oils of pimento, bay, canella, cinnamon, &c. According to G. Laube and H. Aldendorff, the percentage composition of cloves is water 16·39, nitrogenous matter 5·99, volatile oil 16·98, fat 6·20, sugar 1·32, nitrogen free extractive 37·72, cellulose 10·56, ash 4·84. The dried spice yielded nitrogen 1·15, volatile oil and fat 27·72. A principle called *caryophyllin,* which occurs in silky needles in stellate groups, has been isolated from cloves; by the action of nitric acid it is converted into caryophyllic acid. (*Watts, Dict. Chem., 2nd Ed.*)

Commerce.—The imports of cloves into India in 1884-85 were 4,791,006 lbs., valued at Rs. 11,09,841, all from the east coast of Africa and Zanzibar. Of this quantity 4,598,419 lbs. came to Bombay. During the same year Bombay re-exported 1,618,465 lbs., of which 1,112,224 lbs. went to the United Kingdom, and 473,799 lbs. to China and the Straits.

MELALEUCA LEUCADENDRON, *Linn.*

Fig.—*Bentl. and Trim.*, t. 108.

Hab.—Indian Archipelago, Malay Peninsula. The essential oil.

Vernacular.—Kayaputi-ka-tel (*Hind.*), Kaiyappudai-tailam (*Tam.*), Kayaputi-tail (*Beng.*), Kayputi-nu-tel (*Guz.*), Kayaputi-che-tel (*Mar.*).

History, Uses, &c.—This oil appears to have been first prepared as an article of commerce by the Dutch about 1727. Rumphius, who passed nearly fifty years in the Dutch East Indies, and died at Amboyna in 1702, was the first to bring to notice that the Malays and Javanese made use of the leaves on account of their aromatic properties; this led to their distillation, and Rumphius relates how the oil was obtained in very small quantities, and was regarded as a powerful sudorific. It was probably unknown in India before the commencement of the present century, about the time when it first became an article of commerce in England. The island of Bouro in the Molucca Sea is stated by Bickmore, an American traveller, who passed some time there, to produce about 8,000 bottles annually; but from the trade returns of the Straits Settlements it appears that the largest quantity is shipped from Celebes. (*Pharmacographia.*) The oil is much used in India as an external application for rheumatism, and has also been given internally in chronic cases with advantage. It is a powerful stimulant and antispasmodic in choleraic diarrhœa, and on account of its stimulant and rubefacient action it is a useful local application in the chronic forms of pityriasis, psoriasis, eczema and acne so common in India.

Description.—Cajuput oil varies in colour from yellowish green to bluish green; it is a transparent mobile fluid, with an agreeable camphoraceous odour, and bitter aromatic taste, sp. gr. 0·926, it remains liquid at 13° C., and deviates the ray of polarized light to the left.

Chemical composition.—The researches of Schmidt and other chemists have shown that cajuput oil consists chiefly of hydrate of cajuputal or cineol, $C^{10}H^{18}O$, which may be obtained from the crude oil by fractional distillation at 174° C. If it is repeatedly distilled from P^2O^5 it is converted into terpenes. Cineol, a liquid smelling like camphor, is the chief constituent of Ol. Cinæ and Ol. Cajuputi; it occurs also in oil of Rosemary. (*Weber.*) For its reactions and chemical composition the reader is referred to Watt's Dict. of Chem. by Morley and

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Muir (ii. 187). R. Voiry (*Chem. News*, June 15th 1888, p. 241,) states that on fractional distillation cajuput oil yields a terpilenol, which has no action on polarized light. He further obtained acetic, butyric and valerianic ethers mixed with a carbide boiling at 160° in a vacuum.

The green tint of the oil is due to copper, a minute proportion of which metal is usually present in all that is imported. It may be made evident by agitating the oil with very dilute hydrochloric acid. To the acid, after it has been put into a platinum capsule, a little zinc should be added, when the copper will be immediately deposited on the platinum. The liquid may be then poured off, and the copper dissolved and tested. When the oil is rectified, it is obtained colourless, but it readily becomes green if in contact for a short time with metallic copper.

Commerce.—The oil is imported into India from Singapore in large quantities packed in common black quart bottles. From the official trade reports of the latter port it appears that India is the chief market for this article. Average value, Re. 1½ per bottle.

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EUGENIA JAMBOLANA, *Lam.*

Fig.—*Wight Ic., t.* 535 ; *Bedd. Fl. Sylv. i., t.* 197.

Hab.—India. The fruit, leaves, seeds and bark.

Vernacular.—Jámun (*Hind.*), Kálájám (*Beng.*), Jámbú (*Mar.*), Navel (*Tam.*), Jambúdo (*Guz.*), Neredi (*Tel.*), Nevale (*Can.*).

History, Uses, &c.—This tree, which yields an abundant crop of subacid edible fruit, during the hot weather, is common all over the country. In some places the fruit attains the size of a pigeon's egg, and is of superior quality. In Guzerat this large kind is called *Páras-jambudo.* The Jambu has numerous synonyms in Sanskrit, it is called *Meghavarna* (cloud-coloured), *Meghabha* (cloud-like), *Nilaphala* (black-fruited), *Raja-*

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phala (king's-fruit), &c. According to the Dirghama-Sutra it is one of the four colossal mythic trees which mark the four cardinal points, standing to the south of Mount Méru; four great rivers rise at its foot. The Vishnupurana states that the continent of Jambudvipa takes its name from this tree. Ibn Batuta, who visited India in 1332, mentions جمون (*Jamún*) as one of the fruits of Delhi. A vinegar prepared from the juice of the ripe fruit is an agreeable stomachic and carminative; it is also used as a diuretic. A sort of spirituous liquor, called Jámbáva, is described in recent Sanskrit works as prepared by distillation from the juice. The bark is astringent, and is used, alone or in combination with other medicines of its class, in the preparation of astringent decoctions, gargles and washes. The fresh juice of the bark is given with goat's milk in the diarrhœa of children. (*Chakradatta.*) The expressed juice of the leaves is used alone or in combination with other astringents in dysentery, as for example in the following prescription:—Take of the fresh juice of the leaves of *E. Jambolana* and the Mango about a drachm each, Emblic myrobalans a drachm, and administer with goat's milk and honey. (*Bhavaprakasa.*)

The author of the Makhzan notices the Jamún at considerable length; after describing the tree, he says that the fruit is a useful astringent in bilious diarrhœa, and makes a good gargle for sore throat or lotion for ringworm of the head. The root and seeds, he observes, are useful astringents, also the leaves. He tells us that a kind of wine is made from the fruit, and that the juice of the leaves dissolves iron filings, or, as he expresses it, reduces them to so light a condition that they float upon the surface of the liquid as a scum. This when collected and washed he recommends as a tonic and astringent. A wine and syrup of the fruit has been shown to us by Mr. M. C. Pereira of Bombay; they much resemble in flavour similar preparations made with red currants, and appear to have stomachic and astringent properties. Some years ago at Monghyr, in Bengal, excellent brandy was prepared from the fermented fruit. Of late years the seeds of this tree have been recommended as a remedy in diabetes.

Dr. C. Graeser, of Bonn, has published in the *Centralblatt für Klinische Medicin* a highly-interesting account of a series of experiments with the extract of the fruit of *Syzygium Jambolanum* on dogs, which had previously been made diabetic by the administration of phloridzin.

Dr. Graeser thought that the best way of studying the physiological and therapeutic action of the new drug was to administer it to dogs which had artificially been made diabetic by a method introduced by V. Mehring, who found that artificial diabetes can at any moment be produced in dogs by the administration of phloridzin.

A young dog of 2,700 to 4,800 grammes body weight, to which 2·5 to 4·8 grammes of phloridzin (1 gramme to 1 kilo body weight) have been given, in the course of a day will show an excretion of sugar, lasting for twenty-four to thirty hours, and amounting to 5·89 to 12·45 grammes. Graeser first gave the daily dose of phloridzin, but later on he split the quantity into doses of 1 gramme, given every two to three hours. In both cases the excretion of sugar was the same. Diarrhœa was caused by phloridzin in three cases. After Graeser had experimented for some time with phloridzin alone he began to administer simultaneously phloridzin and extract of *Syzygium Jambolanum*. The latter was given before, along with, or after phloridzin, and invariably had the effect of reducing the expected excretion of sugar most considerably. This reduction amounted to at least half, in some cases even to nine-tenths, of the quantity of sugar which would have resulted had phloridzin alone been given. At the same time the duration of the diabetes was shortened. Dogs, which under phloridzin alone had excreted 5·89 to 12·45 grammes of sugar, showed under the jambul treatment a maximum excretion of 2·906 grammes of sugar, and a minimum excretion of 1·5 gramme.

As jambul showed such a powerful effect on the artificially-produced diabetes, it may be anticipated that when given at the proper time and in a large dose it will entirely prevent the excretion of sugar.

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It is not yet known how jambul given in large doses acts on the pathological diabetes mellitus of man. But it is well worth trying. The experiments on man are all the more justified as no ill effect has ever yet been produced by the new drug. A favourable effect of such experiments would prove that phloridzin diabetes and pathological diabetes are of a similar nature.

In all the animals on which Graeser experimented no signs of any secondary effects of jambul extract were observed, not even after doses of 18 grammes. In one case diarrhœa set in, which, as further experiments proved, was caused by phloridzin and not by jambul.

All his experiments were made with extract of jambul prepared by Mr. R. H. Davies, F.I.C., chemist to the Society of Apothecaries, London, from seeds which the author had himself brought over to Europe. As the fruit contains great quantities of starch, it was thought advisable to eliminate this as much as possible in preparing the extract. Several extracts were prepared out of the whole fruit, or solely out of the kernel or solely out of the pericarp ; 100 grammes of the fruit gave 16⅓ grammes kernel-extract, and 11⅔ grammes pericarp extract, The most given in one single dose was 6 grammes, the maximum daily dose 18 grammes.

Whether the active principle is contained in the pericarp or kernel cannot as yet be decided to a certainty. Probably it is contained in both, but to a greater extent in the pericarp.

From the long series of experiments which he has made, Graeser draws the following conclusions :—

1. Phloridzin diabetes is considerably lessened by jambul extract.

2. Jambul extract is non-poisonous, and does not cause any ill effect.

3. The active principle contained in jambul is not yet known. It will have to be determined by careful analysis and further experiments. (*Chem. and Druggist* 1889.)

With reference to Graeser's experiments, G. I. Iaveïne (*Vratch.*, 1889, p. 1029,) records having obtained negative re-

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sults with the seeds in three cases of diabetes in which the urine contained from 6 to 7 per cent. of sugar. In these cases the powdered seeds were given in doses of one gram 4 to 6 times a day.

Description.—The fruit unless improved by cultivation is about the size and shape of a small olive, of a purple colour, and very astringent; within it is a thin white papery shell, which encloses a large green kernel, also very astringent. The bark is grey and fissured externally; internally it is red and fibrous; its minute structure is remarkable in having several rows of very large, pitted, oblong-oval cells, which can be easily seen with the naked eye. The odour is like that of oak-bark, and the taste very astringent. The leaves are 3 to 6 inches long, ovate or oblong, obtuse, more or less acuminate, coriaceous, smooth, shining, closely nerved, the numerous nerves uniting within the margin. When crushed they have an agreeable terebinthinate odour, and on distillation yield a bright green oil.

Chemical composition.—The proximate composition of dry Jambul seeds according to Elborne is—

Essential oil	a trace
Chlorophyll and fat	0·37
Resin soluble in alcohol and ether	0·30
Gallic acid	1·65
Albumin	1·25
Coloured extractive soluble in water	2·70
Moisture	10·00
Insoluble residue	83·73
	100·00

Jambulin, a glucoside, is stated to have been found in the seeds; it is said to have the power of preventing the diastatic conversion of starch, &c., into sugar. The bark of the tree contains 12 per cent. of tannin and affords a Kino-like gum.

Commerce.—The fruit and seeds are sold in the Indian markets.

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PSIDIUM GUYAVA, *Linn.*

Fig.—*Rheede Hort. Mal.* iii., *t.* 34, 35; *Rumph. Amb. i., t.* 47. Guava tree (*Eng.*), Goyavier (*Fr.*).

Hab.—America, naturalized in India. The bark and leaves.

Vernacular.—Lál-safri-ám, Sufed-safri-ám (*Hind.*), Lál-jám, Sufed-jám (*Duk.*), Támbara peru, Pándhara peru (*Mar.*), Shivappu-goyyá-pazham, Vellai-goyyá-pazham (*Tam.*), Tella-jám-pandu, Erra-jám-pandu (*Tel.*), Bili-shibe-hannu, Kempu-shibé-hannu (*Can.*), Dhop-goachhi-phal, Lal-goachhi-phal (*Beng.*).

History, Uses, &c.—The red and white guavas appear to be only varieties of one and the same species. They have been introduced into India from America, probably by the Portuguese, and are now universally cultivated, and in some parts of the country have run wild. The fruit is a favourite with the natives, who like its strong aromatic flavour. It is astringent and has a tendency to cause costiveness. Europeans generally prefer it cooked, or in the form of jelly. In Goa the Portuguese make a kind of cheese of it. The bark, which is also astringent, is recommended in the *Pharmacopœia of India* as a remedy for the chronic diarrhœa of children. Dr. Waitz (*Diseases of Children in Hot Climates*, p. 225,) directs half an ounce of the root bark with six ounces of water to be boiled down to 3 ounces; of this decoction, the dose is one or more teaspoonfuls three or four times a day. He also recommends the same preparation as an external astringent in the prolapsus ani of children (p. 233). The leaves have also been used successfully as an astringent in diarrhœa.

Discourtilz places this plant among the aromatic antispasmodics; a decoction of the young leaves and shoots is prescribed in the West Indies in febrifuge and antispasmodic baths, an infusion of the leaves in cerebral affections, nephritis and cachexia; the pounded leaves are locally applied in rheumatism; an extract is used in epilepsy and chorea; the tincture is rubbed into the spine of children suffering from convulsions. The fruit and its

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conserve are astringent and suitable to those suffering from diarrhœa and dysentery. (*Corre et Lejanne, Résumé de la Mat. Med. Coloniale*, p. 108.)

Description.—The external surface of the bark when fresh is smooth and brown, marked by superficial scars indicating the separation of squamous plates of dead bark. These plates sometimes remain partially attached. Beneath the brown epidermis the fresh bark is green; its inner surface is marked by longitudinal striæ, and is of a light brown colour. The taste is astringent and agreeably acid. The leaves are aromatic, egg-shaped or oblong, short stalked, covered with soft down underneath, and with the principal veins very prominent.

Microscopic structure.—Sections show that the bark consists of an epidermis, made up of two rows of brick-shaped brown cells, and alternate zones of vascular and parenchymatous tissue, varied towards the inner part by three broken circles of liber cells. The medullary rays are numerous, and together with the parenchyma of the outer part of the bark, loaded with green colouring matter; in the rays this extends some distance into its substance, and makes them very conspicuous. The vascular system is loaded with crystals, and contains a few starch granules.

Chemical composition.—The watery extract of the bark contains, as the mean of two determinations, 27·4 per cent. of tannin. Spirit dissolves the same amount of extract from it as water, about 33 per cent. The tannin gives a blue-black colour with ferric salts, a pinkish precipitate with gelatine, and a dirty green with acetate of lead; the lead compound when perfectly dry yields 29 per cent. of oxide.

After exhausting the bark by means of water and alcohol, another colouring matter is removed by soda, probably oxidized tannin. Ether extracts chlorophyll, and a little resin soluble with a bright red colour in alkaline liquids. No alkaloids or ammonia are present. The mineral matter obtained by incineration is 10 per cent., and consists of calcium carbonate

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afforded by the calcium oxalate which is present in the bark in the form of simple crystals. The tannage or inspissated watery extract of guava bark is reddish brown and brittle, very soluble in water, and containing as it does tannin in a free state, should be a useful astringent.

MYRTUS COMMUNIS, *Linn.*

Fig.—*Duhamel ed. nov. t.* 43. Myrtle (*Eng.*), Myrte (*Fr.*)

Hab.—Europe. Cultivated in India. The leaves, fruit and bark.

Vernacular.—Aas (*Arab.*), Vilayati-mehndi (*Hind.*). The berries, Hab-el-aas (*Arab., Ind. bazars*).

History, Uses, &c.—Amongst the ancients the Myrtle (μυρσίνη) was a phallic emblem sacred to Venus, at the festival of Myrrha, the incestuous mother of Adonis, married women wore wreaths of the leaves; and in Virgil's infernal regions the victims of love concealed themselves among the myrtles. At Rome this plant was not allowed to be placed upon the altar of *Bona Dea*, but at the festivals of Eleusis every one was crowned with it; it was supposed not only to inspire love, but to maintain it. According to a Greek myth, the nymph Myrsine, having outstripped Athene in a race, was turned into a myrtle bush by the goddess, who, however, repenting of her cruelty afterwards, became particularly attached to the plant. The Romans, after they had intended fighting for the Sabine women whom they had carried off, purified themselves with sprigs of myrtle, *ideo tunc lecta* (says Pliny) *quoneam conjuctioni et huic arbori præest Venus*. Pliny also tells us that Romulus planted two myrtles at Rome, one of which afterwards became the favourite of the patricians, and the other of the people; when the former had the upper hand the plebeian myrtle withered, but when the power of the latter was in the ascendant the patrician myrtle faded. Before pepper was known myrtle berries were employed as a spice to season food, and wine was flavoured with them. (*Hist. Nat.* 15, 35.) For many other

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superstitions concerning the myrtle extending down to modern times, see De Gubernatis (*Myth. des Plantes, II.*, 233).

The myrtle occupies a prominent place in the writings of Hippocrates, Pliny, Dioscorides, Galen, and the Arabian writers. Pliny furnishes an account of it, of which the following is a summary: The berries arrest hæmoptöe; they are used in dysentery and as an application to indolent ulcers and inflamed eyes; and in wine are an antidote to the poison of mushrooms; they also cure the bites of scorpions, inflammation of the bladder, headaches, abscesses, aphthæ, leucorrhœa, and other mucous discharges. The juice is diuretic, but constipates. An ointment made with it cures eruptions of the skin and darkens the hair. The dried leaves in powder arrest sweats; in fomentations check the white flux, correct prolapsus of the womb and rectum, and are employed to cure ulcers, burns, erysipelas, otorrhœa, alopecia, and eruptions of the skin, to arrest hæmorrhage, and as an application to lentigo, pterygion, panaris, condylomata, and swelled testicles. A wine made from the berries was used for most of these purposes, and was regarded as tonic. This catalogue of virtues is repeated, but hardly enlarged, by subsequent ancient writers, who, however, following Galen, ascribe to myrtle the opposite qualities of cold and hot, or astringent and stimulant, the former residing chiefly in the leaves, the latter in the berries.

In 1876 attention was directed to the medicinal properties of the plant by Delioux de Savignac, who recommended an infusion or diluted tincture of the leaves as an astringent lotion, and the finely powdered leaves as an application to ulcers, &c. He also used the powder in doses of 1 to 4 grams internally in chronic catarrh of the bladder and in menorrhagia; and the infusion in chronic bronchitis. The *Oxymyrsine* or "wild myrtle," mentioned by the ancients, the *Aas-el-bari* of Mahometan writers, is not a myrtle, but the *Ruscus aculeatus* or "butcher's broom."

Of late years the volatile oil of myrtle leaves has been brought to notice as an antiseptic and rubefacient when used externally; given internally, in small doses (0·06 to 0·09 gram), it

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promotes digestion like myrtle berries, but in large doses it acts as an irritant. It is excreted by the kidneys and through the respiratory tracts, and communicates a peculiar odour to the urine. According to Lauder Brunton the urine of persons taking it gives a precipitate with nitric acid; he considers that like copaiba it may be used as an expectorant in chronic bronchitis with profuse expectoration and in chronic inflammation of the bladder or urethra. It is best administered in gelatine capsules containing 4 to 5 drops of the oil. The fragrant water distilled from the flowers and leaves is known in France as *Eau d' ange*. According to Brannt, the manufacturers of volatile oils in Southern France place a myrtle water upon the market which is actually prepared from the oil.

Chemical composition.—Riegel (1849) obtained from the ripe berries a volatile oil, resin, tannin, citric acid, malic acid, sugar, etc. Rayband (1834) found the volatile oil, as distilled from the leaves, flowers, and fruit, to have a yellowish or greenish-yellow colour, and to be lighter than water. Gladstone (1863) ascertained it to have a specific gravity of ·891, to be dextrogyre, and to consist mostly of a hydrocarbon, $C^{10}H^{16}$, boiling between 160° and 170° C. E Jahns (1889) examined a sample of Spanish origin, having a sp. gr. of ·910 at 16°, and a rotatory power of $[a] = +26 \cdot 7°$. On fractional distillation the terpene, $C^{10}H^{16}$, came over at 158°-160°; rotatory power $[a]_D = +36 \cdot 8°$, and corresponded in its chemical properties with dextropinene. Cineol, boiling at 170°, a second constituent, was obtained by Wallach's process. A little camphor was also present but could not be isolated. (*Journ. Chem. Soc.*, June, 1889.) The bitter principle has not been investigated; it is probably a glucoside.

Commerce.—Dried myrtle berries are obtainable in most of the Indian bazars.

MELASTOMACEÆ.

MEMECYLON EDULE, *Roxb.*

Fig.—*Roxb. Cor. Pl. I., t.* 82; *Wight Ic., t.* 278. Ironwood tree (*Eng.*), Mémecylon comestible (*Fr.*).

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Hab.—Eastern and Western Peninsulas, Ceylon.

Vernacular.—Anjana, Yálki, Kurpa, Lokhandi (*Mar.*), Kashamaram (*Tam.*), Alli-cheddu (*Tel.*), Surpa (*Can.*), Warikaha, Seroo-kaya (*Cingh.*).

History, Uses, &c.—*M. edule,* also called *M. tinctorium* from its use in dyeing, is a shrub or small tree growing on hilly ground. In Sanskrit it is called Anjani, a name derived from *anjana*, a pigment or collyrium. The leaves are used in India and Ceylon as a dye, and afford an evanescent yellow lake when used alone. They are chiefly valued on account of their action as a mordant, and are used with myrobalans and Sappan wood or Chayroot (*Oldenlandia umbellata*) in preference to alum in producing a deep red colour much used by matmakers in Madras. Medicinally, an infusion of the leaves is used as an astringent collyrium in conjunctivitis, and a decoction of the root in menorrhagia. The pounded bark with aromatics, such as ajwan, pepper, and zedoary is tied up in a cloth for fomentation or applied as a plaster (*lep*) to bruises. Dr. Peters has brought to our notice the use of the leaves in the Deccan as a remedy for gonorrhœa of considerable repute. Sprengel, apparently misled by the Cinghalese name Warikaha, supposed the leaves to be source of the Wars dye of the Arabians.

Description.—The *Flora of British India* notices twelve varieties of this extremely variable plant, which is generally a large bush, remarkable for its bright green foliage, and clusters of purplish-blue flowers on the bare branches, which are succeeded by globose deep purple berries about ¼ inch in diameter, and crowned with the 4-toothed limb of the calyx. The berries are edible but astringent. The leaves are from 1½ to 3½ inches in length, and 1 to 1¼ inch broad, entire, firm, and leathery, with short petioles, and very indistinct lateral venation, they turn yellowish-green when dry; the taste is acid, bitter and astringent.

Chemical composition.—Prof. Dragendorff (*Pharm. Zeitchr. für Russland*, xxi., 232,) proved the absence of an alkaloid,

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and the presence of a yellow glucoside in the leaves. The latter he considered not to bear any resemblance to chrysophanic acid.

A proximate analysis of the leaves, which we have made, indicated the following constituents:—

Moisture	6·90
Chlorophyll and resins	5·59
Resins, malic acid and glucose; spirit extract	16·00
Colouring matter, gum, malates and glucose; water extract	17·94
Dissolved by soda solution	4·42
Starch and pararabin removed by boiling dilute HCl	23·32
Crude fibre and silica	25·83
	100·00

The total malic acid amounted to 6·48 per cent., glucose 6·25, and the total inorganic matter 11·80 per cent. The alcoholic extract was brown in colour, sweet and styptic to the taste, and nearly all soluble in water; the solution readily reduced Fehling's solution, and gave a crystalline precipitate with lead acetate. The aqueous solution was yellow-coloured; it afforded a precipitate of mucilage and salts with two volumes of alcohol, and gave a crystalline precipitate with lead acetate. A decoction of the leaves afforded a green colour with iodine solution through the blending of the natural colour with the starch iodide. The colouring matter is freely soluble in water, sparingly in spirit, and insoluble in ether. The aqueous solution is turned greenish-brown by ferric chloride and is not affected by gelatine, the colour is not precipitated by neutral plumbic acetate or by acids; it is intensified by the fixed and volatile alkalies. The glucosidal decomposition is preferably effected by boiling with dilute hydrochloric acid, which results in the deposition of a red powder attended with the formation of a volatile substance having the odour of saffron. The red decomposition product is very sparingly soluble in water, insoluble in ether, and very soluble in rectified spirit and dilute alkaline liquors; a spirit solution is precipitated by ether. It

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affords an intense yellow colour with diluted alkali, and orange brown when concentrated, and is precipitated in brown flocks by acids. Sulphuric acid forms with it a yellowish-brown solution, from which it separates on standing in a pulverulent condition; nitric acid dissolves it with the formation of a fine red hue. The decomposition product is resinoid and amorphous, and is neutral in reaction.

LYTHRACEÆ.

AMMANNIA BACCIFERA, *Linn.*

Fig.—*Lam. Ill., t. 77, f.* 5.

Hab.—Tropical India. The herb.

Vernacular.—Dád-mári (*Hind.*), Guren, Bhár-jambúl (*Mar.*), Kallurivi, Nirumel-neruppu (*Tam.*), Agni-venda-páku (*Tel.*), Kallur-vanchi (*Mal.*)

History, Uses, &c.—Ammannia is supposed by some to be the Agni-garbha, "or plant pregnant with fire" of Sanskrit writers, but this is very doubtful, as the same name is applied to the Arani or soft wood used in the production of the sacrificial fire. The properties of this plant and its use by the natives as a blistering agent appear to have been first brought to the notice of Europeans by Roxburgh. Ainslie quotes him, and remarks that the plant has a strong muriatic smell, but not disagreeable; the leaves are extremely acrid, and are used by the natives to raise blisters in rheumatism, fevers, &c., the fresh leaves bruised and applied to the part intended to be blistered, perform their office in half an hour, and most effectually. In Pudukota, under the name of *Sigappuppugai*, the plant is used to prepare a liniment which is applied to the temples as a remedy for burning pain in the eyes. The author of the *Bengal Dispensatory* states that he made a trial of the leaves in eight instances; "blisters were not produced in less than twelve hours in any, and in three individuals not for 24 hours. The bruised leaves had been

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removed from all after half an hour. The pain occasioned was absolutely agonizing until the blister rose; they caused more pain than cantharides, and were far inferior to the *Plumbago rosea* in celerity and certainty of action." According to Fleming, the leaves are applied to cure herpetic eruptions. The authors of the *Pharmacopœia of India* merely notice the unfavourable opinion of the drug expressed in the *Bengal Dispensatory.* We have made some experiments with an ethereal tincture of the leaves, which lead us to form a much more favourable opinion of them; in several instances it blistered rapidly, effectually, and without causing more pain than the liquor epispasticus of the *Pharmacopœia,* which it resembles in colour. Upon evaporation of the ether a dark green resinous extract is left. A spirituous tincture was also tried, but it was not nearly so efficient. Dr. Bholanath Bhose describes a mode of treatment of obstinate spleen disease by the juice of the leaves administered internally, but its administration in this manner has been objected to as causing pain and yielding uncertain results. In the Concan the juice is given with water to animals when in heat to extinguish sexual appetite; the plant fresh or dried is administered in decoction with ginger and Cyperus root for intermittent fevers, and its ashes are mixed with oil and applied to herpetic eruptions. Ammannia is common in low moist ground in India, and flowers in November and December.

Description.—An herbaceous, erect, much-branched plant, having foliage something like that of rosemary; stems 4-sided; leaves sessile, opposite, lanceolate, attenuated, about an inch long and ⅛ inch broad, much smaller on the upper parts of the plant; calyx 4-cleft to the middle; lobes acute; accessory teeth very small; flowers very minute, aggregated in the axils of the leaves, almost sessile; tube of the calyx at first narrow and tightened round the ovary, in fruit cup-shaped; petals wanting; capsule longer than the calyx, 1-celled; flowers red. The whole plant has an aromatic and rather agreeable odour.

Chemical composition.—An alcoholic extract prepared with 80 per cent. alcohol was made from the air-dried and powdered

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plant: the greater part of the alcohol distilled off, and the remainder allowed to evaporate by exposure to air. When free from alcohol the extract was boiled with water, and the liquid separated from insoluble matter while hot. The filtrate was at first of a dark reddish brown colour, but became turbid on cooling, a dark resin separating on the sides of the capsule: no crystalline matter separated. After standing for some days the fluid was separated from suspended matter, and agitated with ether. The ether extract was of a yellow colour, indistinctly crystalline, possessed a very aromatic odour, and had a strongly acid reaction. An aqueous solution gave a deep brownish, almost black precipitate with ferric salts: with ammonia a deep caramel yellow colour, which darkened somewhat on exposure. With alkaloidal reagents negative results were obtained; after boiling with dilute sulphuric acid, the solution slightly reduced Fehling's solution, indicating the probable presence of a glucoside. Some of the aqueous solution rubbed on the skin of the arm produced no vesication. The dark resin which separated on the sides of the capsule on boiling the alcoholic extract with water, dried to a brittle black mass, but with a purple tinge, in thin layers. This substance was easily soluble in alkalies, and was reprecipitated by acids in cinnamon coloured flocks. With cold nitric acid it dissolved at once, forming a deep reddish liquid, which after standing for a short time evolved nitrous fumes. In acetic acid it was also soluble, but less readily than in nitric acid. In ether it was insoluble. An alcoholic solution gave with ferric chloride a black precipitate, which was changed to dark brown on the addition of acids. Applied to the skin in alcoholic solution negative results were obtained. That portion of the alcoholic extract originally insoluble in water consisted of resinous matter. Some of the powdered plant was distilled with water, the distillate had a slight odour, but yielded practically no extractive when agitated with ether. In one experiment the distillate afforded a very faint red coloration with ammonia, but on repeating the experiment negative results were obtained. An alcoholic tincture of the plant applied to the skin of the arm produced no vesication, and a similar negative

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result was also obtained with an ethereal solution, and though there is very little doubt that plumbagin is the active principle of the drug, only in one experiment was any reaction similar to that yielded by plumbagin obtained. It is probable that the sample operated on was inactive from the failure to obtain any vesication with an ethereal solution of the whole plant, more especially as a subsequent distillation of seven pounds of the dried and powdered drug from another source yielded a distillate having the strong aromatic odour of plumbagin, and which when shaken with ether afforded a yellow crystalline substance which, on re-solution, gave a red colour with alkalies.

WOODFORDIA FLORIBUNDA, *Salisb.*

Fig.—*Roxb. Cor. Pl.*, *t.* 31; *Bot. Mag.*, *t.* 1906. Downy Grislea (*Eng.*), Grisléa multiflore (*Fr.*).

Hab.—Throughout India. The flowers.

Vernacular.—Dhái, Dávi, Devti (*Hind.*), Dhaití, Dhaoshi, Phulsatti (*Mar.*), Dhaiphul (*Beng.*), Serinjí (*Tel.*), Dhátaki (*Can.*).

History, Uses, &c.—The Sanskrit names of this shrub well describe its prominent characters. It is called Agni-jvála (fire-flame), Tamra-pushpi (red-flowered), Guchchha-pushpi (cluster-flower), Párvatí (hill-born). The usual name is Dhátaki. It is mentioned by Chakradatta and Sarangadhara on account of its astringent properties. As a medicine the flowers are chiefly prescribed by the natives in dysentery, beaten up with honey into a kind of confection. They are also thought to be of use in menorrhagia; externally they may be used as an astringent. The natives of the Concan in bilious sickness fill the patient's mouth with sesamum oil, and apply the juice of the leaves to the crown of the head; this is said to cause the oil in the mouth to become yellow from absorption of bile; fresh oil is then given repeatedly until it ceases to turn yellow. Commercially the flowers are of considerable importance as a dyeing and tanning material.

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Description.—The flowers and their calices are red, the latter are permanent, and retain their colour after the flower has faded. As met with in commerce the calices generally contain the nearly mature capsules, which are two-celled and two-valved and completely enclosed. The seeds are light brown, very minute, oblong and very numerous; if the calyx is soaked in water it will be seen to be 12-toothed. In ordinary samples of the article some of the flowers are in small racemes, and a good many lanceolate leaves with a whitish under surface studded with black dots are mixed with them; both sides of the leaf will, if examined with a lens, be seen to be covered by a close dense tomentum. The enlarged calices are very astringent.

Chemical composition.—The flowers yielded to Hummel 20·6 per cent. of tannic acid, which explains their use by the Hindus in connection with alum as a mordant and with other dye-stuffs. (*Watt, Select. from the Records of the Govt. of India, Vol. I., pp.* 91 *and* 93.)

Commerce.—The article is collected in large quantities. Value, Rs. 15—25 per kandy of 5¼ cwts. The variation in price depends upon the quantity in the market.

LAWSONIA ALBA, *Lam.*

Fig.—*Lam. Ill., t.* 296, *f.* 2; *Wight Ill., t.* 87; *Griff. Ic. Pl. Asiat. t.* 580. Henna (*Eng.*), Henné (*Fr.*).

Hab.—Western India; cultivated throughout India. The leaves and flowers.

Vernacular.—Méhndí (*Hind.*), Mendi (*Mar., Guz.*), Marutonri, Aivanam (*Tam.*), Méhédi (*Beng.*), Goranta (*Tel.*), Gorante (*Can.*).

History, Uses, &c.—Henna is the Mendika and Raktagarbha, or "plant pregnant with red colouring matter," of Sanskrit writers. It is much esteemed by the Mahometans. There is a tradition that their Prophet spoke of it as "*Syyadu* *riáhin*" (the best of herbs). In Arabic it is called Hinna. Arabic and Persian works give Arkán and Fákúliyún as the Greek names;* they describe the leaves as a valuable external application in headache, combined with oil so as to form a paste, to which resin is sometimes added. They are applied to the soles of the feet in small-pox, and are supposed to prevent the eyes being affected by the disease. They also have the reputation of promoting the healthy growth of the hair and nails. An ointment made from the leaves is spoken of as having valuable healing properties, and a decoction is used as an astringent gargle. The bark is given in jaundice and enlargement of the spleen, also in calculous affections, and as an alterative in leprosy and obstinate skin diseases, in decoction it is applied to burns, scalds, &c. The seeds, with honey and tragacanth, are described as cephalic. An infusion of the flowers is said to cure headache, and to be a good application to bruises; a pillow stuffed with them has the reputation of acting as a soporific. (*Dr. Emerson.*) An ointment is also applied to bruises, and a perfumed oil is prepared from them, which is called in Arabic Duhn-el-fághiya and is used as a cosmetic.

Ainslie notices the use of an extract prepared from the flowers and leaves by the Tamil physicians of Southern India as a remedy in lepra, half a teaspoonful twice a day being the dose. He also says that the leaves are applied externally in cutaneous affections. In the Concan the leaf-juice mixed with water and sugar is given as a remedy for spermatorrhœa, and with milk in the condition popularly known as "hot and cold fits."

In the *Pharmacopœia of India* attention is drawn to their use in an obscure affection called "burning of the feet," often met with in India; and the editor mentions his having himself witnessed, when in Burmah, a great amount of tempo-

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* The κυπρος of Dioscorides (i., 109,) and Cyprus of Pliny (13, 51; 23, 46) appear to be Henna, as 'the leaves dye the hair of an orange colour.' Arkan ارقان is an Arabic word meaning a blight or disease which turns plants or men yellow (jaundice).

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rary relief from the remedy when numerous other means had previously failed. The fresh leaves beaten up into a paste with vinegar were applied as a poultice to the soles of the feet in most cases, but some patients obtained greater relief from using strong frictions with the bruised leaves over the part. In Southern India Henna seeds are called *Iswan*, a corruption of the Persian word Isband or Ispand, a name applied to the seeds of *Peganum Harmala* by the Persians. They are used by the Mahometans of those parts as a substitute for the true Ispand in certain superstitious observances. (*See Peganum.*)

The use of Henna for dyeing the hands and feet appears to be common among Mahometans in Asia and Africa, and was probably practised by the ancient Egyptians and Jews. Sir G. Birdwood has the following remarks upon its history in more Western countries:—"Solomon is supposed by Sprengel to refer to the Henna plant in his Epithalamium (I. 14), 'My beloved is unto me as a cluster of Samphire (or Cypress or Camphire) in the vineyards of Engedi.'" It is undoubtedly the κυπρος of Dioscorides and "Cyprus in Egypt" of Pliny. It is mentioned by Avicenna also under the name of "Henna."*

Description.—Leaves opposite, smooth, short petioled, oblong, or broad lanceolate, pointed at both ends, an inch or more long and less than half an inch broad; the flowers are in terminal, globular, cross-armed panicles, small, greenish white and very fragrant; the fruit is round, the size of a pepper-corn, four-grooved, with the apex depressed, four-celled; the seeds are angular. The decoction of the leaves is of a deep orange colour, which is destroyed by acids, and deepened by alkalies and vegetable astringents; it stains the skin of an orange red colour, which does not disappear until the epidermis has been renewed.

Chemical composition.—The colouring matter of Henna is a kind of tannin to which M. Abd-el-Aziz Herraory has given the name of *hennotannic acid*. This principle is brown, of a

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* Cf. P. Bellonius Obs. II. 64. He visited Egypt in A. D. 1547.

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resinoid appearance, and soluble in boiling water. It possesses the properties of tannin, such as blackening ferric salts and precipitating gelatine. It reduces oxide of copper in Trommer's test, and heat decomposes it, with the production of crystalline needles, which reduce nitrate of silver. (*Jour. de Pharmacie, Jan.* 1863.) According to C. J. S. Thompson the leaves yield to boiling water from 12 to 15 per cent. of the brown colouring matter, which is soluble in glycerine, strong solutions of potash and ammonia, and dilute acids, but very slightly in ether, chloroform or alcohol: the leaves also yield 2 per cent. of an olive-green resin soluble in ether and alcohol.

PUNICA GRANATUM, *Linn.*

Fig.—*Bentl.* and *Trim., t.* 113. Pomegranate (*Eng.*), Grenadier commun (*Fr.*).

Hab.—Socotra, Arabia, Africa (?). Cultivated throughout India. The fruit, rind, and root bark.

Vernacular.—Anár, Dárim (*Hind.*), Dálim (*Beng.*), Dálimba (*Mar.*), Dádam (*Guz.*), Mádalai (*Tam.*), Dánimma (*Tel.*), Dálimbe (*Can.*); the flowers, Julnár, Gulnár (*Arab., Pers., Hind.*), Pu-madalai (*Tam.*), Puvvu-dánimma (*Tel.*), Hushi-dálimbe (*Can.*).

History, Uses, &c.—The pomegranate, which by Dierbach's account is the Ροα Σίδη of Hippocrates, is in culture in the south of Europe, Arabia, Japan, Persia, and Barbary. It is also much cultivated in India, but the Indian fruit is greatly inferior to that which is imported from the Persian Gulf ports. The Sanskrit name is Dádima, and the fruit is called Shukadana (parrots' food) and Kuchaphala (breast fruit). Hindu physicians prescribe the juice of the ripe fruit combined with saffron as a cooling medicine. They also use the rind of the fruit and the flowers, combined with aromatics, such as cloves, cinnamon, coriander, pepper, &c., as an astringent in such bowel affections as are not accompanied with tenesmus. In the Concan the juice of the green fruit, rubbed with galls, cloves and ginger is given in honey as a remedy for piles. The juice of the flowers with Durva root juice (*Cynodon dactylon*) is used to stop bleeding from the nose. The root bark does not appear to be mentioned in any Sanskrit works on Materia Medica. The Arabs call the pomegranate Rummán; Anár is the Persian name. Mahometan writers describe three kinds, sweet, sour, and subacid. The Rummán-i-bari or Wild Pomegranate of these writers is, perhaps, the *P. protopunica* discovered by Balfour in Socotra, and which probably exists in the neighbouring continents of Africa and Arabia, but this name is also applied by the Arabs to the Tutsan or large Hypericum. Besides using the flowers and rind in a variety of ways on account of their astringency, they recommend the root bark as being the most astringent part of the plant, and a perfect specific in cases of tapeworm : it is given, in decoction, prepared with two ounces of fresh bark, boiled in a pint and a half of water till but three-quarters of a pint remain; of this when cold a wineglassful may be drunk every half hour, till the whole is taken. This dose sometimes sickens the stomach a little, but seldom fails to destroy the worm, which is soon after passed.*

The seeds of the pomegranate are considered to be stomachic, the pulp cardiacal and stomachic. It would appear that the Arabs derived their knowledge of the medicinal qualities of this plant from the ancients, as a similar account of them is found in Dioscorides and Pliny. The *balaustium* of these writers is the double pomegranate flower, a word which in the corrupted form of Balusitun is common in Arabic and Persian books.† The root bark and rind of the fruit are official in the *Pharmacopœia of India*. The official preparation of pomegranate root bark is open to objection on account of its nauseousness, and Mr. Siebold, in order to obviate this, has suggested a process for removing the astringent principles. (*Pharm. Journ.* [3], XIV., 396.) With a similar object Dr. Von Schroeder

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* Compare with Dioscorides i., 131, περὶ ρόας.

† Plin. 13, 34; 23, 57 to 61; Scribon. Comp. 85 and 112; Dios. i., 132; it is used to stop bleeding in accordance with the doctrine of signatures.

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has recommended the use of an extract free from tannic acid, but containing all the alkaloids of the bark. (*Pharm. Zeit.*, 1886, *Sept.* 18, p. 556.) The extract is prepared by treating a decoction of the bark with milk of lime to remove the tannic acid, filtering, neutralizing the filtrate exactly with sulphuric acid, evaporating it on a water bath almost to dryness, treating the residue with 70 per cent. alcohol, and then driving off the alcohol from the extract obtained, the product is described as nearly entirely crystalline and soluble in water with a slight turbidity. The yield is about one gram of extract from twenty grams of bark. In order to retard as much as possible the absorption of the pelletierine, which is present in the extract as a sulphate, it is recommended to add to this quantity one or two grains of tannic acid to convert the alkaloid into the difficultly soluble tannate.

It has been stated occasionally that the administration of pelletierine to adults has been followed by symptoms of poisoning, though not very serious ones, and this has caused hesitation in administering it to children. Some recently reported cases appear, however, to indicate that the physiological action of this tænifuge is relatively less energetic in infants than in adults. (*Archiv. der Pharm.*, *Sept.* 1886, p. 409.) Dr. Méplain administered six centigrams of pelletierine to a child two and a half years old, and Dr. Bétencès the same quantity to a child five years old without the least symptom of poisoning, but with the removal of the worm in both cases. In another case a dose of ten centigrams was successfully administered to a child ten years of age. (*Pharm. Journ.*, *Oct.* 2, 1886.)

Description.—The fruit of the pomegranate tree, in botanical language a *balausta*, is a spherical somewhat flattened and obscurely six-sided berry of the size of a common orange, and often much larger, crowned by the thick, tubular, 5 to 9-toothed calyx. It has a smooth, hard, coriaceous skin, which, when the fruit is ripe, is of a brownish yellow tint, often finely shaded with red. Membranous dissepiments, about 6 in number meeting in the axis of the fruit, divide the upper and larger portion into equal

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cells; below these, a confused conical diaphragm separates the lower and smaller half, which in its turn is divided into 4 or 5 irregular cells. Each cell is filled with a large number of grains, crowded on thick spongy placentæ, which in the upper cells are parietal but in the lower appear to be central. The grains, which are about $\frac{1}{2}$ an inch in length, are oblong or obconical and many-sided, and consist of a thin transparent vesicle, containing an acid, saccharine, red juicy pulp surrounding an elongated angular seed.

The peel as imported is in irregular, more or less concave fragments, some of which have the toothed, tubular calyx still enclosing the stamens and style. It is $\frac{1}{20}$ to $\frac{1}{10}$ of an inch thick, easily breaking with a short corky fracture; externally it is rather rough, of a yellowish brown or reddish colour. Internally it is more or less brown or yellow, and honeycombed with depressions left by the seeds. It has hardly any odour, but has a strongly astringent taste. The bark occurs in rather thin quills or fragments, 3 to 4 inches long. Their outer surface is yellowish grey, sometimes marked with fine longitudinal striations or reticulated wrinkles, but more often furrowed by bands of cork, running together in the thickest pieces into broad flat conchoidal scales. The inner surface, which is smooth or marked with fine striæ, and is of a greyish yellow, has often strips of the tough whitish wood attached to it. The bark breaks short and granular; it has a purely astringent taste, but scarcely any odour. (*Pharmacographia.*)

Microscopic structure.—The middle layer of the peel consists of large thin-walled and elongated, sometimes even branched, cells, among which occur thick-walled cells and fibro-vascular bundles. Both the outer and the inner surface are made up of smaller, nearly cubic and densely-packed cells. Small starch granules occur sparingly throughout the issue, as well as crystals of oxalate of calcium. In a transverse section of the bark, the liber is seen to be the prevailing part of the cortical tissue. The former consists of alternating layers of two kinds of cells, one of them loaded with tufted crystals of oxalate of calcium, the other filled with starch granules and astringent matter. The bark is traversed by narrow medullary rays, and very large sclerenchymatous cells are scattered through the liber. Touched with a dilute solution of a persalt of iron, the bark assumes a dark blackish blue tint.

Chemical composition.—"The bark contains, according to Wackenroder (1824), more than 22 per cent. of tannic acid, which Rembold (1867) has ascertained to consist for the most part of a peculiar variety called Punico-tannic Acid, $C^{20}H^{16}O^{13}$; when boiled with dilute sulphuric acid, it is resolved into Ellagic Acid, $C^{14}H^{8}O^{9}$, and sugar. Punico-tannic acid is accompanied by common tannic acid, yielding by means of sulphuric acid, gallic acid, which appears sometimes to pre-exist in the bark. If a decoction of pomegranate bark is precipitated by acetate of lead, and the lead is separated from the filtered liquid, the latter on evaporation yields a considerable amount of mannite. This is probably the Punicin or Granatin of former observers." (*Pharmacographia, 2nd Ed., p.* 291.) Tanret (1878) announced the discovery of a liquid alkaloid which has the tænicide power of the bark. The alkaloid is obtained in a pure state by distilling its ethereal solution in a current of hydrogen, and maintaining the residue at a temperature of 130° to 140° C. until it no longer gives off the vapour of water. The temperature is then raised, and the liquid collected that distils between 180° and 185° C.

Pelletierine so obtained is colourless, but in the open air or in flasks incompletely filled it becomes coloured very rapidly. At zero its sp. gr. is. 0·999 and at 21° C. 0·985. It is very soluble in water, with which it undergoes a contraction of volume, a mixture of 1 part of pelletierine with 2·5 parts of water having at 21° C. a sp. gr. of 1·021.

Pelletierine is dextrogyre, having in aqueous solution a rotatory power of $[a]_J = +80$, that of the sulphate prepared with the distilled alkaloid is + 5·98. With sulphuric acid and potassium bichromate pelletierine gives a green colour as intense as alcohol under the same conditions.

Analyses of the alkaloid as well as of the crystalline salts that it forms with sulphuric and hydrochloric acids indicate the

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formula $C^9H^{15}NO$. It therefore furnishes another example of a volatile oxygenated base, near to conhydrine, $C^8H^{17}NO$ and tropine, $C^8H^{15}NO$. From some experiments made by Tanret it appears that the bark of the fibrillæ of the roots contains by far the largest proportion of alkaloid, *viz.*, 2·25 per cent. when dry. Tanret subsequently obtained from the bark a second alkaloid, *isopelletierine*, having anthelmintic properties, and two inactive alkaloids.

Commerce.—Pomegranate root bark is seldom to be met with in the shops, as few gardens are without the plant; it is freshly dug when required. The rind is brought to Bombay from the Persian Gulf ports chiefly. Value, Re. 1⅛ per maund of 37½ lbs. The dried seeds are also imported.

ONAGRACEÆ.

JUSSIÆA SUFFRUTICOSA, *Linn.*

Fig.—*Rheede Hort. Mal. ii., t.* 50; *Lam. Ill., t.* 230, f. 3.

Hab.—India, Ceylon. The plant.

Vernacular.—Làl-bon-lavanga (*Beng.*), Ban-laung (*Hind.*), Pána-lavanga (*Mar.*), Nir-kirambu (*Tam.*), Kavacula (*Can.*), Hæmarago (*Cingh.*).

History, Uses, &c.—Rheede under the name of *Carambu* describes this plant as medicinal, and gives as its Sanskrit name Bhállavi-anga; no such name, however, appears in the list of plants mentioned by Sanskrit writers. Bhállavi is the name of a man, and Bhállavi-anga would signify "having a body like Bhállavi." According to Rheede a decoction of this plant is used in Malabar to dissipate flatulence, act as a diuretic, purge the body and destroy worms; when ground small and steeped in butter-milk it is administered in dysentery. Ainslie quotes Rheede, and says that the plant is called *Hœmarago* in Ceylon. Miller, he says, has noticed the resemblance of its fruit to the clove, and in Jamaica *J. repens* is used as an astringent in spitting of blood and flux. (*Mat. Ind. ii.*, 66.) The plant is

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also noticed by Loureiro (*Fl. Cochin.* 226) under the name of *Epilobium fruticosum*. The Indian vernacular names all bear testimony to the resemblance of the fruit to a clove, and the Marathi name "water-clove" indicates the habitat of the plant, which is similar to that of our European willow herb (*Epilobium angustifolium*). The astringent properties of Jussiæa appear to be known to the peasantry in most parts of India.

Description.—An erect, branching, suffruticose plant, 4 to 6 ft. Leaves 3 by ¾ in., more or less villous, ovate-lanceolate, sometimes nearly linear, shortly petioled or sessile. Pedicel very short. Calyx-lobes broadly lanceolate or ovate. Petals 4, yellow, obovate. Capsule 1-2 in., linear-cylindric, more or less villous, 8-ribbed, membranous, breaking up between the ribs.

SAMYDACEÆ.

CASEARIA ESCULENTA, *Roxb.*

Fig.—*Bedd. Fl. Syl., t.* 208.

Hab.—Malabar, Bombay to Coorg, Ceylon.

Vernacular.—Mora-ágerú, Bithori, Pingri, Mormassi (*Mar.*), Sátaganda (*Goa.*), Gundu-gungura (*Tel.*), Kaddlashingi, (*Tam.*), Chilla, Chilara, Bairi (*Hind*).

History, Uses, &c.—The species of Casearia found in India are not numerous, most of the genus being natives of America, where several species are used medicinally. *C. esculenta* is a small shrub of very variable appearance and not unlike the species *tomentosa* figured by Rheede (*Hort. Mal. v.,* 50) which he calls *Tsjerou-kanelli*, and for which he gives the following synonyms.—Fruita caurins do mato (*Port.*), "Wild cowrie fruit," Wilde dwerg appelen (*Dutch*), "Wild dog apple." Bedousi (*Brah.*).

Roxburgh tells us that the roots of *C. esculenta* are used as a purgative by the inhabitants of the Circar hills, that he tried unsuccessfully to extract a colouring matter from the fruit, and that the young leaves are eaten in stews.

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In Western India the root has a great reputation as a remedy for hepatic enlargements and for piles. A decoction made by boiling 90 to 120 grains of it for a dose in a pint of water down to one quarter of a pint is administered internally three times a day, and a paste made by braying the root on a stone is sometimes applied locally as well when piles are present. The administration of the drug promotes the action of the liver, and the local application may be of use as the root is astringent. The Marathi word मोड (*mora*) signifies a pile, and आगेरु (*ágeru*) the intestinum rectum. Sátagauda is compounded of सात (*sáta*) seven, and गंड (*ganda*) a ring, and is applied to this plant because the transverse section of the largest roots shows seven concentric dark rings. Mormassi is a compound of Mora with a corruption of the Sanskrit मषी (*mashi*), which signifies a soft tumour. The root has long been known as a drug used by the Goanese in Bombay, but its source was only accidentally discovered in 1888 when breaking up some waste land for cultivation. In native practice the root is administered in decoction with garlic, and sometimes the leaves and root are given on the Western coast. We have received the root from Dr. P. S. Mootooswamy of Tanjore, who states that it is used in the South as a remedy for diabetes, for which disease it is considered to be a specific. An extract of the root has been administered by us in doses of from 10 to 20 grains or more in a number of cases of chronic hepatic congestion with decided benefit; it removes the feeling of weight and tension in the hepatic region and acts as a gentle aperient upon the bowels. A syrup of the strength of 20 grains of extract in two fluid drachms has also been found to be an efficient preparation.

Description.—The root is from ½ to 2 inches in diameter, often very crooked, forming angular bends; it consists of a central red woody column, having seven or a less number of dark concentric rings. The bark is of a deep dull-red colour, thick, and extremely hard, it is covered with a thin papery suber of an ochre-yellow colour. The taste is astringent. The root yields to water an abundant dark reddish-brown extract.

GSL

The powder has a cobweb-like character due to the length and silkiness of the liber cells.

Chemical composition.—Operating upon the root-bark, ether removed 3 per cent. of brownish-yellow resin, partly soluble in spirit, with a neutral reaction. Alcohol extracted about 13 per cent. of dark-red colouring matter consisting mostly of tannic acid. This extract was only partly soluble in water, the insoluble portion became clear with ammonia, but the liquid rapidly pectinised. The tannic acid gave a brownish-green colour with ferric salts. The aqueous extract was also dark coloured, and nearly half of it was precipitated by neutral plumbic acetate as one or more organic acids. This extract and that part of it forming a lead compound was tested physiologically and found to have a cathartic effect; the lead compound gave 53·5 per cent. of Pb O, and the acid separated from lead by sulphuretted hydrogen possessed some of the characters of cathartic acid. The portion of aqueous extract not precipitated by lead contained a neutral principle crystallizing in white transparent prisms. The root had still another colouring matter removed by soda solution, a small quantity of starch, and it left 4·8 per cent. of mineral matter when burnt. The tannin of Casearia root is related to Ratanhia-tannic acid, in the composition of its lead salt and in yielding a crystalline sugar when boiled with acids. The insoluble tannin is also similar to the Ratanhia red.

PASSIFLOREÆ.

CARICA PAPAYA, *Linn.*

Fig.— *Bot. Reg.* 459. Papaw (*Eng.*), Papayer (*Fr.*).

Hab.—America. Cultivated throughout India. The milky juice.

Vernacular.—Papiya, Arand-kharbuz (*Hind.*), Paipai (*Beng.*) Papai (*Mar.*), Pappali-maram (*Tam.*), Bapaia-pandu (*Tel.*), Parangi (*Can.*)

History, Uses, &c.—In the Brazils the hermaphrodite variety of *C. Papaya* is called mamao macho (male mamao), the fruit-bearing variety mamao femea (female mamao), and a cultivated variety of the latter mamao melao (melon mamao). The anthelmintic properties of the milky juice were first noticed in the 17th century by Hernandez. Its digestive action upon meat was probably known in the West Indies at a very early date, and appears to have been communicated to the inhabitants of India upon the introduction of the tree by the Portuguese, as it has long been the practice to render meat tender by rubbing it with the juice of the unripe fruit or by wrapping it in the leaves. The author of the Makhzan-el-adwiya (A.D. 1770) accurately describes the tree, and mentions the use of the juice, mixed with that of fresh ginger, for making meat tender. Medicinally, he says, it is a remedy for hæmoptysis, bleeding piles, and ulcers of the urinary passages; it is also useful in dyspepsia; rubbing the milk in two or three times cures ringworm, or psoriasis (قوبا) causing a copious serous exudation attended with itching. (*Op. cit. sub voce Papiya.*) The attention of the profession in India was called to the use of the milk as an anthelmintic in 1810 by Dr. Fleming (*Asiatic Researches*, Vol. XI.), who cites an interesting passage from the writings of M. Charpentier Cossigni in support of its alleged virtues. Further confirmatory evidence has more recently been adduced by M. Bouton (*Med. Plants of Mauritius*, 1857, p. 65), and it may justly be concluded that the statements as to its efficacy as an anthelmintic are founded on fact. The following mode of administration employed by the late Dr. Lemarchand, of the Mauritius (cited by Bouton), it would be desirable to adopt in all future trials with this remedy. Take of fresh Papaw milk, honey, of each a tablespoonful; mix thoroughly, gradually add three or four tablespoonfuls of boiling water; and when sufficiently cool take the whole at a draught, following its administration two hours subsequently by a dose of castor oil, to which a portion of lime-juice or vinegar may be added. This may be repeated two days successively if required. The above is a dose for an adult; half

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the quantity may be given to children between 7 and 10 years of age; and a third or teaspoonful to children under 3 years. If it cause griping, as it occasionally does, enemas containing sugar have been found effectual in relieving it. Taking the dose above named as correct, the statement of Sir W. O'Shaughnessy (*Bengal Dispensatory*, p. 352), that he had administered the milky juice as an anthelmintic, in doses of from 20 to 60 drops without obvious effect, is fully explained. It is principally effectual in the expulsion of lumbrici. On tænia it is reported to have little effect. Anthelmintic virtues have also been assigned to the seeds, but the evidence of their efficacy is very inconclusive. A belief in their emmenagogue properties prevails amongst all classes of women in Southern and Western India, and also in Bengal; so much so, that they assert that if a pregnant woman partake of them, even in moderate quantities, abortion will be the probable result; the same prejudice exists against eating the fruit. Facts in support of the alleged emmenagogue properties of the Papaw are still wanting. (*Phar. of India*, p. 97.) Lt.-Col. Cox has brought to the notice of the Madras Agri-Horti-cultural Society that the leaves are used in the south to extract guinea-worms; an ounce of the leaf is rubbed with 60 grains of opium and 60 grains of common salt, and the paste applied to the part. "Of course the worm has to be wound out in the usual manner, but it always comes out more quickly and easily when treated in this way."

Evers has employed the milk in the treatment of splenic and hepatic enlargement with good results; a teaspoonful with an equal quantity of sugar divided into three doses was administered daily. (*Ind. Med. Gaz., Feb.* 1875.) In 1877, the milky juice began to attract attention in Europe as a digestive ferment, and Herr Wittmack (1878) examined its properties with the following results:—He obtained, after repeated incision of a half ripe fruit, 1·195 grammes of white milky juice of the consistence of cream. This dried in a watch glass to a hard vitreous white mass, having what appeared to be greasy spots on the surface, but which really were flocks of a gelatinous substance that always adheres to the more hardened material.

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The odour and flavour of the fresh juice recalled that of petroleum or of vulcanised india-rubber. The microscope showed it to be a fine grumous mass containing some larger particles and isolated starch grains. Iodine coloured the juice yellowish brown. A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grammes of quite fresh lean beef in one piece in distilled water, and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments made without the juice the boiled meat was visibly harder. Hard boiled albumen, digested with a little juice at a temperature of 20° C., could after twenty-four hours be easily broken up with a glass rod. 50 grammes of beef in one piece, enveloped in a leaf of *C. papaya* during 24 hours at 15° C., after a short boiling became perfectly tender; a similar piece wrapped in paper and heated in the same manner remained quite hard. Some comparative experiments were also made with pepsin, and the following are the conclusions arrived at by the author:—

(1) The milky juice of the *Carica papaya* is (or contains) a ferment which has an extraordinarily energetic action upon nitrogenous substances, and like pepsin curdles milk; (2) this juice differs from pepsin in being active without the addition of free acid, probably it contains a small quantity, and further it operates at a higher temperature (about 60° to 65° C.) and in a shorter time (5 minutes at most); (3) the filtered juice differs chemically from pepsin in that it gives no precipitate on boiling, and further that it is precipitated by mercuric chloride, iodine, and all the mineral acids; (4) it resembles pepsin in being precipitated by neutral acetate of lead, and not giving a precipitate with sulphate of copper and perchloride of iron. (*Pharm. Jour., Nov.* 30, 1878.)

The active principle has since been separated and given the name of *Papain*; it is now an article of commerce in Europe for medicinal purposes, and is said to be capable of digesting 200 times its weight of fibrin; it has been used as a solvent of diphtheritic false membrane, and also as a local application

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in old standing cases of chronic eczema, more especially of the palms of the hands, and where other remedies failed great benefit has attended its application in the following way :—12 grains of papain, and 5 grains of powdered borax, in 2 drachms of distilled water, to be painted on the parts twice daily.

In the *Therapeutic Gazette* (1886), Dr. A. Jacobi records successful results in several cases in which papain was applied topically to diphtheritic membranes. In these cases a mixture of one part of papain and two parts each of glycerine and water were applied with a brush; within twelve hours the membrane began to slough off, and was freely expectorated. Similar results were obtained in England a few years before this, but a want of uniformity and hence uncertainty to a certain extent prevented the remedy coming into general use.

Dr. George Herschell (*Brit. Med. Journ.*, 1886, p. 640,) records the treatment of the chronic stomach catarrh of children with powders composed of *Papain-Finkler*, gr. ½ to 1; Sacch. lactis, gr. i; Sodii Bicarb., gr. v., to be taken after every meal. This relieves the aggravating symptoms of dyspepsia, such as loss of appetite and sleep, irritability, headache, and sometimes a cough, which so much affect children. Dr. Herschell believes that the remedy acts by dissolving the mucus, which accumulates in unusual quantity upon the stomach and intestines and prevents absorption of food. In the acid dyspepsia of adults, when heartburn and flatulence are the chief indications of impaired digestion, he finds papain valuable in conjunction with carbolic acid and an alkali, as in the following draught :—Sodii Bicarb. gr. xv., Glycer. acid. carbolic., m. viii.; Spt. Ammon. Arom., m. xx., Aquæ ad ℥iss. This is to be taken an hour after food along with 2 grains of Papain-Finkler. (*Chem. and Druggist*, 1886.)

Description.—The tree is from 20 to 30 feet high, without branches when young, but old trees often produce a number of separate heads. The leaves are alternate, palmate, 7-partite; segments oblong, acute, sinuated, the middle one 3-fid; corolla tubular in the male and 5-lobed in the female, divided nearly to the base into five segments; male flowers axillary in slightly compound racemes or panicles, white; female generally on a different tree, in the axils of the leaves, large and fleshy, yellowish; fruit succulent, oblong, furrowed; the size of a small melon, yellowish-green when ripe, and containing a number of round, grey, slimy seeds, which smell like cress. In the unripe state the fruit abounds in a thick milky juice.

Chemical composition and Physiological action.—The fruit has been examined by Dr. T. Peckolt (*Zeitschr. des Oesterr. Apoth. Ver.* 1879, 361—373); it was gathered in the full-grown but unripe condition, when it contains a considerable quantity of milky juice, which disappears almost entirely after it has been kept for a few days. The analysis of the fresh fruit of the three varieties freed from acid gave the following numbers:—

	Fruit of female plant.	Fruit of female cultivated plant.	Fruit of Hermaphrodite plant.
Caoutchouc-like substance	......	......	0·046
Soft yellow resin	0·165	......	......
Reddish yellow fat	......	0·020	......
Albuminoids	1·070	0·500	0·735
Sugar	3·238	3·580	4·333
Pectinous matter	1·315	0·483	2·332
Tartaric acid } Combined with bases.	0·075		
Citric acid	0·020		
Malic acid	0·083		
Dextrin, &c	5·503		
Water	85·351	92·500	89·445
Cellulose	3·180	2·920	5·091

The fresh fruit of the female plant gave 1·239 per cent. of ash, and the dried fruit 8·457 per cent. It contained a large amount of soda, potash, and phosphoric acid. The ripe fruit contained no free acids.

The seeds contain an oil, *papaya oil; caricin*, an oil-like substance with a disagreeable taste and smell, soluble in ether and alcohol; an acid similar to palmitic acid, *Carica fat acid;* a crystalline acid, *Papayic acid*, insoluble in cold water, but soluble in hot water and alcohol; a resin acid, having an irritating and bitter taste, insoluble in water and ether, soluble in alcohol and alkalies; and a soft resin similar to that found in the fruit flesh of the female plant. (*Year-Book of Pharmacy*, 1880, p. 212.) Dr. Sidney Martin (*Journ. Physiol.* V., 213—230, and VI., 336—360; *Journ. Chem. Soc.* 1886, 641,) has shown papain to be a protolytic ferment, which acts very similarly to trypsin.

Experiments performed with fibrin and white of egg showed that some degree of digestion occurs when the liquid is faintly acid (0·05 per cent. of HCl); the presence of more acid than this hinders the action of the ferment. Digestion takes place actively only in neutral or in alkaline solutions (0·25 per cent. of sodium carbonate); it occurs most readily at a temperature between 35° and 40° C. The results of digestion are peptones, leucine and tyrosine and an intermediate globulin-like substance, similar to that formed in pancreatic digestion.

In the author's second paper on the same subject the ferment in papaw juice is shown to be associated with an albumose, and to give the following reactions in addition to those previously described by Wurtz:—The solution gives a biuret reaction, and it is precipitated from a neutral solution of sodium, magnesium sulphate or sodium chloride alone, as globulins are. It is soluble in glycerol, and if precipitated from this solution by alcohol, the filtrate has no proteolytic power. The kind of albumose is one nearly akin to the protalbumose of Kühne and Chittenden, and is called α-phytalbumose. Papaw juice also contains a milk-curdling ferment. The proteids present in papaw juice were found to be as follows:—

(1) Globulin, resembling serum globulin in its most important properties.

(2) Albumin.

(3) β-phytalbumose precipitated almost completely by heat, by saturation with neutral salts, but not by dialysis. It differs from the heteroalbumose of Kühne and Chittenden by not being precipitated by dialysis, by copper sulphate, or by mercuric chloride.

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(4) α-phytalbumose; soluble in cold or boiling water; not precipitated by saturation with neutral salts, except in an acid solution. This is the vegetable peptone referred to by Vines (*Journ. Physiol.* iii.) as hemialbumose. It differs from the protalbumose of Kühne and Chittenden by its non-precipitation by sodium chloride or by copper sulphate. Both these albumoses give the biuret reaction.

No peptones occur in the juice, but leucine and tyrosine are present. By a series of digestion experiments carried out on each of these proteids by papain in a neutral liquid, it was found that both the globulin and albumen are changed into β-phytalbumose, and that this becomes a peptone-like substance, and forms leucine and tyrosine. The α-phytalbumose becomes a similar peptone-like substance, leucine and tyrosine being formed. This peptone-like substance resembles the deuteroalbumose of Kühne and Chittenden, except that a solution of it, when rendered acid by acetic acid in the presence of sodium chloride, does not become cloudy on warming. No true peptones are formed. Probably digestion in the plant itself is very slow, as much more liquid was used in the experiments than is present in the juice. The albumose forms probably the circulating proteid in the plant. (*Year-Book of Pharm.*, 1886, p. 97).

CUCURBITACEÆ.

CITRULLUS COLOCYNTHIS, *Schrad.*

Fig.—*Wight Ic., t.* 498; *Bentl. and Trim.,* 114. Bitter apple (*Eng.*), Coloquinte (*Fr.*).

Hab.—India, Asia, Africa. The fruit and root.

Vernacular.—Indráyan (*Hind.*), Indráyan (*Guz.*), Peykomatti, Tumatti (*Tam.*), Kuruvrandawan (*Mar.*), Eti-puchcha, Chittipápara (*Tel.*), Dodda-hal-mekki (*Can.*), Indráyan (*Beng.*).

History, Uses, &c.—Wild colocynth is common in waste tracts of North-West, Central and South India, and

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ripens in the cold season. Aitchison observes that it is very common all over the desert country of Beluchistan, where it is called *Khar-kushta*. The fresh fruit is brought for sale by the herbalists; it is grown in the North-West Provinces for the use of the Government Sanitary Establishments.

Sanskrit writers describe the fruit as bitter, acrid, cathartic and useful in biliousness, constipation, fever and worms. They also mention the root as a useful cathartic in jaundice, ascites, enlargements of the abdominal viscera, urinary diseases, rheumatism, &c. Sarangadhara gives a receipt for a compound pill, which contains Mercury 1 part, Colocynth pulp, Sulphur, Cardamoms, Long Pepper, Chebulic myrobalans, and Pellitory root, of each 4 parts. The Sanskrit names for colocynth are Indraváruni and Vishálá. In India the fruit or root, with or without nux vomica, is rubbed into a paste with water and applied to boils and pimples. In rheumatism equal parts of the root and long pepper are given in pills. A paste of the root is applied to the enlarged abdomen of children. (*Compare with Scrib. Comp.* 80, *and Pliny* 20, 8.)

Mahometan writers call the colocynth plant Hanzal, and discuss its properties at great length. They consider it to be a very drastic purgative, removing phlegm from all parts of the system, and direct the fruit, leaves and root to be used. The drug is prescribed as with us, when the bowels are obstinately costive from disease or lesion of the nervous centres, also in dropsy, jaundice, colic, worms, elephantiasis, &c. Its irritant action upon the uterus is noticed, and fumigation with it is said to be of use for bringing on the menstrual flow.* The author of the Makhzan describes a curious method of administration. A small hole is made at one end of the fruit and pepper-corns are introduced, the hole is then closed, the fruit enveloped in a coating of clay and buried in the hot ashes near the fire-place for some days; the pepper is then removed and used as a carminative aperient. A similar preparation is made with rhubarb root instead of pepper. The same author tells us that the seeds are purgative, and mentions their use for preserving the hair from turning grey, a purpose for which *"bitter apples"* are apparently employed in England in the present day. As regards the purgative properties of the seeds he is incorrect, for when thoroughly washed they are eaten by the Arabs in time of famine. Colocynth was familiar to the Greeks and Romans.*

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* Compare Hippocrates de morb. mulier. ii., 50.

Description.—The Indian fruit is nearly globular, of the size of an orange, smooth, marbled with green and yellow when fresh, yellowish-brown when dry, and contains a scanty greyish-white pulp in which a number of brown seeds are embedded. This pulp in the fresh fruit is spongy and juicy, and occupies the whole of the interior of the fruit. Peeled colocynth is unknown in the Indian market except as an import from Europe. The seeds are disposed in vertical rows on three thick parietal placentæ, which project to the centre of the fruit, then divide and turn back, forming two branches directed towards one another. The seeds are of flattened ovoid form, 3-10ths of an inch long by 2-10ths broad, not bordered. The testa is hard and thick, with a finely-granulated surface, and is marked on each side of its smaller end by two furrows directed towards the hilum. The leaves are glabrous and nearly smooth above, muricated beneath, with small, white, hair-bearing tubercles, many cleft and lobed, the lobes obtuse. The root is fibrous, tough and stringy, of a yellowish-white colour. All parts of the plant are very bitter, and the dust when dry very irritating to the eyes and nostrils.

Chemical composition.—The bitter principle was isolated by Hübschmann in 1847, by Lebourdais in 1848, and by Walz (1858), who treated alcoholic extract of colocynth with water, and mixed the solution firstly with neutral acetate of lead, and subsequently with basic acetate of lead. From the filtered liquid the lead was separated by means of sulphuretted hydrogen, and then tannic acid added to it. The latter caused the colocynthin to be precipitated; the precipitate washed and dried

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* *κολοκύνθίs*, Theophr. H. P i., 19, 22. vii., 1, 3, 6; Dios. iv, 171; Colocynthis, Plin. 20, 8.

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was decomposed by oxide of lead, and, finally, the colocynthin was dissolved out by ether.

Walz thus obtained about ¼ per cent. of a yellowish mass or tufts, which he considered as possessing crystalline structure, and to which he gave the name *colocynthin*. He assigns to it the formula $C^{56} H^{84} O^{23}$. Colocynthin is a violent purgative.

Colocynthin is decomposed, according to Walz, by boiling dilute hydrochloric acid, and then yields *colocynthein*, $C^{44} H^{64} O^{15}$, and grape sugar.

The same chemist termed *colocynthitin* that part of the alcoholic extract of colocynth, which is soluble in ether, but not in water. Purified with boiling alcohol, colocynthitin forms a tasteless crystalline powder.

The pulp perfectly freed from seeds and dried at 100°C., affords 11 per cent. of ash; the seeds alone yield only 2·7 per cent. (*Pharmacographia.*) The seeds contain after decortication about 48 per cent. of fatty oil and 18 per cent albuminous substances besides a small quantity of sugar. (*Flückiger.*)

We have examined the roots dried at 50° C., and reduced to powder; the powder contained a large amount of starch and woody fibre; for the chemical examination, no separation of fragments of woody fibre by a sieve was attempted, the powdered roots being used as a whole.

Dry ether was digested with a known weight of the powder for some days, and was found to extract ·14 per cent. only. The extractive was of a yellow colour, bitter, and consisted chiefly of oily matter. Water digested with this extract acquired a very bitter taste. Another portion of the powder was exhausted with 84 per cent. alcohol, by which treatment 12·62 per cent. of a soft yellow non-crystalline extract was obtained dried at 100° C.

By the action of cold water on the extract, ·88 per cent. of insoluble, soft yellow residue was left; this residue was not bitter, and its alcoholic solution had a marked acid reaction. It had the properties of a fat acid. The aqueous extractive was somewhat milky; repeated filtration failed to make it bright: it

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was acidulated with acetic acid and agitated with acetic ether. The acetic ether extract was yellow and most intensely bitter, it amounted to ·3 per cent. calculated on the roots. The greater part of this extract was soluble in water, the solution being intensely bitter. The residue insoluble in water consisted of fatty matter, and after repeated washing with water, it still had a bitter taste. The aqueous solution of the acetic extract gave with tannic acid a white curdy precipitate.

Acetic ether appears to be a better solvent for colocynthin than light petroleum ether, and it can be separated from either an acid or alkaline solution by the reagent. The acetic ether extract soluble in water may be looked upon as crude colocynthin. Henke appears to have obtained about ·6 per cent. of colocynthin from the commercial drug freed from seeds, while Walz obtained about ·25 per cent.

Commerce.—In the months of December and January fresh colocynth fruit is brought into the towns for sale. The dried entire fruit is sold in the shops. Large parcels collected and dried up-country sometimes make their appearance in the drug market. Average value, Re. 1 per 100 fruits. The fruit supplied from Saharunpore, N.-W. Provinces, in no way differs from that collected in the Deccan.

The extract prepared in India for use in the Government hospitals is made from the dry fruit after the seeds have been shaken out, as the scanty pulp cannot well be separated from the rind. This extract is quite as active as the best quality obtainable in Europe. The yield is about 110 lbs. of the compound extract from 60 lbs of dried fruit.

CITRULLUS VULGARIS, *Schrad.*

Fig.—*Hook. Kew Journ. Bot., iii., t.* 3. Water-melon (*Eng.*), Melon d'eau (*Fr.*)

Hab.—Cultivated throughout the East. The seeds.

Vernacular.—Tarbuj (*Hind.*), Tarmuj (*Beng.*), Kalingada (*Mar.*), Pitcha-pullum (*Tam.*), Kárigu (*Guz.*).

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History, Uses, &c.—The distinction between the Water-melon and the cultivated form of *C. Colocynthis* is very small. The water-melon has either sweet or bitter fruit: when the latter, it is the *Citrullus amarus* of authors. *C. fistulosus*, Stocks, has thick stems, leaves sparingly lobed, and is plentifully supplied with long somewhat hispid hairs. (*Fl. Br. Ind.*) In India a small cultivated variety of *C. vulgaris*, known as *Dilpasand*, is commonly cultivated as a vegetable; it is globular, about as large as colocynth fruit, does not become sweet when ripe, and is used in the same manner as the Vegetable Marrow. The seeds of the water-melon are of interest as being one of the four cold cucurbitaceous seeds of the ancients, which, according to Guibourt, were originally those of *Cucumis sativus*, L., *Cucumis Citrullus*, DC., (the water-melon), *Cucumis Melo*, L., and *Lagenaria, vulg. clavata*, DC., but he remarks that in Paris the seeds of *Cucurbita Pepo*, Duch., and *Cucurbita maxima* (the *potiron* of the French) are now substituted for those of *Cucumis Citrullus* and *Lagenaria vulgaris*. In India the four cold cucurbitaceous seeds sold in the bazars are those of *Cucumis utilissimus*, *Benincasa cerifera*, *Cucumis Melo*, and *Citrullus vulgaris*. These seeds are in constant demand, and are kept decorticated and ready for use. The natives always use them together, and consider them to be cooling, diuretic, and strengthening. They are sold for about Re. ¾ per pound. The juice of the water-melon is used with cumin and sugar as a cooling drink. In Sind the dried fruit of *Citrullus amarus*, under the name of *Kirbut*, is used as an emetic, and in small doses with honey as a stomachic for children. (*Murray.*) Popularly the use of water melons is supposed to be specially conducive to choleraic seizures, but the evidence upon which this opinion is based appears to us wholly inconclusive. According to Brannt the seeds of this melon are brought from Senegal to France, where they are pressed, yielding as much as 30 per cent. of a fluid pale yellow oil which is used as a table oil and in the manufacture of soap.

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CUCUMIS TRIGONUS, *Roxb.*

Fig.—*Wight Ill., t.* 105; *Ic., t.* 497; *Rheede, Hort. Mal.* viii., 11. Var. pubescens, *Royle Ill., t.* 47; *Wight Ic., t.* 496.

Hab.—India. The fruit.

Vernacular.—Bislambhi (*Hind.*), Káttut-tumatti (*Tam.*), Adavi-puchcha (*Tel.*), Kátvel, Kárit (*Mar.*), Hal-mekki (*Can.*).

Var. pubescens, Takmaki (*Mar.*).

History, Uses, &c.—This plant occurs in two very distinct forms, the wild bitter form has smooth fruits about the size and shape of a small egg, marked with green and yellow streaks like colocynth. The pubescent or semi-cultivated form has velvety fruits which are quite sweet when ripe, and are eaten as a vegetable when green. The wild fruits are never eaten, but are used sometimes medicinally in the same way as *Citrullus amarus*. The seeds are considered very cooling, and are beaten into a paste with the juice of *Cynodon dactylon* (Durva) and applied to herpetic eruptions.

The bitter gourd, is like colocynth, called Vishálá in Sanskrit, and is brought for sale in the Concan at the feast of the Divali or new year of the Hindus, as there is a custom at that season of crushing it under the foot and then applying it to the tongue and forehead to avert disease during the new year. This custom is unknown in the Deccan.* In Malabar the plant is

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* Dr. R. G. Bhandarkar informs us that a Kârit is crushed after the ceremonial bath early in the morning on the Naraka Chaturdasî, or the first day of the Divâlî. The religious manuals usually consulted direct the whirling round oneself while bathing of a twig of Apâmârga (*Achyranthes aspera*), of Tumbî (*Leucas zeylanica*) and of Prapunâṭa or Chakramarda (*Cassia Tora*), and in the verse that is repeated on the occasion, the Apâmârga is prayed to to remove sins. Probably some purificatory properties were observed in these three plants, and on that account the power of spiritual purification was also attributed to them. But the idea associated with the Kâriṭ does not seem to be this. It is probably the same as that which underlies the practice of eating Nimba leaves on new year's day or the Varshapratipadâ. These leaves are bitter and supposed to improve the digestive power; by eating them, therefore, one clears off the indigestions of the previous year, and fits oneself for entering on another year's course. The Kâriṭ being bitter, probably came to be used for the same reason, especially as one has to eat a great many sweet things during the Divâlî festival. The religious manuals do not prescribe the use of Kâriṭ or even allude to it.

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supposed to be alexipharmic, and to have the power of removing all pains and aches. The fruit pounded or boiled with cow's milk and applied to the head is supposed to prevent insanity, strengthen the memory, and remove vertigo. It is the Baliamucca-piri of Rheede, who gives *Tindalica* as the Portuguese, and *Miltea* as the Dutch name. His brahminical name *Carinti* is Marathi, and most of his brahminical names are derived from the South Concan dialect of that language, showing that he obtained his information concerning the medicinal properties of plants from Shenvi and Sarasvat Brahmins who had migrated to Malabar from the Southern Concan. Modern investigation has shown that the medicinal properties of this gourd in no way differ from those of colocynth.

Chemical composition.—The dried fruit was digested with 84 per cent. alcohol, and the resulting tincture concentrated until most of the alcohol had been expelled; water was then added, and the mixture agitated with petroleum ether. The petroleum ether extract consisted of a soft dark reddish brown residue, which left a greasy stain on paper: with the exception of a few flocks it was soluble in alcohol, with acid reaction and bitter taste. On allowing the alcoholic solution to evaporate, some small warty masses separated which were destitute of crystalline structure under the microscope. After agitation with petroleum ether, the aqueous solution, still containing some alcohol, was heated on the water bath to drive off all the spirit, and the soft extract was then mixed with water and agitated with acetic ether containing some acetic acid. The acetic ether extract was reddish brown, very bitter and partly soluble in boiling water. The insoluble residue was brittle when cold and very bitter, and had the properties of a resin, and would appear to correspond with the *resin of colocynth* described by Meissner and others.

The aqueous solution obtained by the action of boiling water on the acetic ether extract was cooled and mixed with aqueous tannic acid, and the curdy precipitate separated by filtration and slightly washed; thorough washing was not possible owing the precipitate caking on the sides of the filter. The drained

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but still moist precipitate together with the filter was now well triturated with freshly precipitated carbonate of lead and the creamy mixture dried. The dry residue was boiled with alcohol, and on evaporating off the alcohol a slightly yellow amorphous residue was left, brittle when cold and easily reduced to a slightly yellow powder, which possessed an extremely bitter taste. On spontaneous evaporation of an alcoholic solution, a crystalline residue was obtained, in which prisms were detected on microscopic examination. Generally the reactions afforded by this bitter principle agreed with those usually ascribed to colocynthin. It failed, however, to yield any *dark green greasy precipitate* with boiling aqueous hydrochloric acid, as is mentioned in Muir and Morley's edition of *Watts' Chemical Dictionary*. We further tested a sample of colocinthin, which had been obtained from Dr. Schuchardt of Görlitz, for this reaction, but with negative results. Regarding the production of this dark green greasy precipitate; on boiling colocynthin with concentrated aqueous hydrochloric acid, the first effect of heat was the formation of a clear reddish yellow solution; on continued ebullition the liquid became darker and turbid, and on the surface a dirty white scum appeared, wholly destitute of any green tinge, and on diluting with water, the scum became of a light reddish dirty tint.

The dried fruit with a few seeds lost 12·22 per cent. when heated to 100° C. The ash amounted to 9·74 per cent.

LAGENARIA VULGARIS, *Seringe.*

Fig.—*Rheede Hort. Mal. viii., t.* 5; *Wight Ill., t.* 105. The bottle gourd (*Eng.*).

Hab.—Cultivated throughout India. The fruit.

Vernacular.—Tumba, Belaschora-tumbi, Karwa-tumba (*Hind.*), Tikta-lau (*Beng.*), Karu-bhopala, Bhopala (*Mar.*), Shorakai (*Tam.*), Anapa-kai (*Tel.*), Gara-dudi (*Mal.*).

History, Uses, &c.—The shell of this gourd when dried is much used in the East as a vessel for holding fluids of all kinds, and for making the native guitar or *Tambura.* The fruit often attains an enormous size, and is used as a buoy for crossing rivers and transporting baggage. Amongst the Hindus as amongst the Greeks gourds are considered to be emblematic of fecundity, prosperity, and good health. There are two varieties of the bottle gourd, a sweet one, called in Sanskrit *Alábu*, and a bitter one known as *Katutumbi*. The fruit varies much in shape. The outer rind is hard and ligneous, and encloses a spongy white flesh, very bitter, and powerfully emetic and purgative. The seeds are grey, flat, and elliptical, surrounded by a border which is inflated at the sides but notched at the apex; their kernels are white, oily, and sweet. In India the pulp in combination with other drugs is used in native practice as a purgative; it is also applied externally as a poultice. The seeds were originally one of the four cold cucurbitaceous seeds of the ancients, but pumpkin seeds are now usually substituted for them.

The Hindus administer a decoction of the leaves in jaundice; it has a purgative action.

Toxicology.—Dr. Burton Brown notices the poisonous properties of the bitter variety of this gourd, the symptoms observed being similar to those after poisoning by elaterium or colocynth.

BENINCASA CERIFERA, *Savi.*

Fig.—*Rheede Hort. Mal. viii., t. 3.*

Hab.—Cultivated throughout India. The fruit.

Vernacular.—Petha (*Hind.*), Kumra (*Beng.*), Kohala (*Mar.*), Búrda-gúmúdu (*Tel.*), Bhurun-koholun (*Guz.*), Kumbuli (*Tam.*), Kuvali (*Mal.*).

History, Uses, &c.—Dutt in his Hindu Materia Medica gives us the following account of the medicinal use of this gourd which is called Kushmánda in Sanskrit:—"The fruit is considered tonic, nutritive and diuretic, and a specific for hæmoptysis and other hæmorrhages from internal organs. It would appear that the old Sanskrit writers were not acquainted with its peculiar action on the circulatory system by which it rapidly puts a check to hæmorrhage from the lungs. The Raja Nirghantu, the oldest work on therapeutics, gives a long account of its virtues, but does not allude to its use in phthisis or hæmoptysis. Neither does Susruta mention it in his chapters on the treatment of hæmorrhage and phthisis, though the plant is alluded to by him elsewhere. The more recent compilations, such as Chakradatta Sangraha, Sarangadhara, &c., give numerous preparations of the article; of these Khanda Kushmándaka or the confection may be taken as an example. In preparing this medicine, old ripe gourds are selected. Those not at least a year old are not approved. They are longitudinally divided into two halves, and the pulp scraped out in thin flakes by an iron comb or scraper. The watery juice that oozes out abundantly during this process is preserved, the seeds being rejected. The pulp is boiled in the juice until soft. It is then tied up tightly in a cloth, and the fluid portion allowed to drain away. The softened and drained pulp is dried in the sun, and the watery portion preserved for future use. Fifty tolás of the prepared pulp are fried in sixteen tolás of clarified butter, and again boiled in the juice of the fruit, till reduced to the consistence of honey. To this are added fifty tolás of refined sugar, and the whole is heated over a gentle fire till the mass assumes such a consistency as to adhere to the ladle. The pot is now removed from the fire, and the following substances, namely, long pepper and ginger, each two tolás, cumin seeds, cardamoms, cinnamon, folia malabathri, black pepper and coriander, each half a tolá in fine powder, are added to the syrup and stirred briskly with a ladle, till the mass is cool. Eight tolás of honey are now added to the confection, which is preserved in a new earthen pot. The dose is from one to two tolás, according to the age and strength of the patient. It is prescribed in hæmoptysis, phthisis, marasmus, cough, asthma, &c., &c."

In the Concan this preparation is made by steaming the rind and pulp cut fine, when well softened it is tied up in a cloth and allowed to drain, saffron, nutmeg, cardamoms and melted sugar are then added.

In insanity, epilepsy and other nervous diseases the fresh juice of the fruit is given either with sugar or as an adjunct to other medicines. According to Dr. Savinge of Rajamundry it has been used with success in diabetes, 4 ozs. of the juice with 100 grs. each of saffron, and the bran of red rice, are given morning and evening and a strict diet enjoined.

The fruit of *B. cerifera* is sub-rotund, 12 to 15 inches in diameter, hairy when young, smooth with a whitish bloom when ripe.

TRICHOSANTHES PALMATA, *Roxb.*

Fig.—*Wight Ill.*, *tt.* 104, 105.

Hab.—Throughout India. The fruit and stem.

Vernacular.—Lal-indráyan (*Hind.*), Kaundal (*Mar.*), Mákál (*Beng.*), Koratti, Shavari (*Tam.*), Avagude (*Can.*), Kakapalam (*Mal.*), Avaguda, Abuvva (*Tel.*).

History, Uses, &c.—Sanskrit writers describe Mahákála as a kind of gourd with an exterior resembling an orange, but with pulp like cowdung. Mahákala is also a name of Ganesha, the god of wisdom, the causer and remover of obstacles, the son of Shiva and Parvati. This gourd is used as a ear ornament (kundala) for the figure of Ganesha or Ganpati, which is dressed up and seated in state in every Hindu house once a year, to bring good luck to the inmates. At this season large quantities of the fruit are brought for sale in the markets. The plant and fruit are considered medicinal. According to Ainslie, the fruit pounded and intimately blended with warm cocoanut oil is considered a valuable application for cleaning and healing offensive sores inside the ears, and is also used to cure ozæna. The root is said by Wight to be used as a cattle medicine, especially in inflammation of the lungs. In the *Bengal Dispensatory* it is stated that numerous trials were made

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with the fruit to ascertain whether it had purgative properties. Three grain doses thrice daily produced no sensible effect.

In Bombay the natives sometimes smoke it as a remedy for asthma. Sir T. Madava Row proposed in the Indian papers (1888) this remedy for the Crown Prince of Germany.—"Take the external cover of the fruit of *T. palmata*, powder it, and inhale the smoke of it, like that of tobacco. Do this three times a day for three days. This is found in an important work in Sanskrit on medicine." The root with an equal portion of colocynth root is rubbed into a paste and applied to carbuncles; combined with equal portions of the three myrobalans and turmeric, it affords an infusion which is flavoured with honey and given in gonorrhœa. *T. palmata* is supposed by some to be the *Hanzal ahmar* or red colocynth of Mahometan writers.

Description.—The fruit is round, oval, or pyriform, the size of a small apple, crimson when fresh, of a dull orange colour when dry, marked at one end by a deep cicatrix with sharp raised edges, at the other there is a prominence to which a portion of the stalk sometimes remains attached. In the dry fruit, which has a thin, brittle, very bitter shell, the segments of pulp with their seeds are loose, so that the contents of the gourd rattle. If a dry segment be soaked in water it soon softens, yielding a dark green pulp which smells like savine, and has an acrid and bitter taste. The seeds, ranging in number from 60 to 100 in each fruit, are flat, but very irregular in shape, generally somewhat triangular, and average 7-16ths of an inch in length; they have a hard blackish shell, and sweet oily kernel. The vine is perennial, often as thick as a man's arm; it has a warty grey bark, marked by seven deep longitudinal fissures, which correspond to the medullary divisions between seven wedge-shaped woody and vascular bundles into which the stem is divided. The vine is not bitter.

Chemical composition.—The rind and pulp of the fruit contain an amorphous bitter principle soluble in water and alcohol, and very slightly in ether. It gives an abundant precipitate with tannin and reduces Fehling's solution. Sulphuric acid forms at first, a yellow solution passing to orange red and purple. Fröhde's reagent colours it first orange, then reddish brown, and finally greenish brown. The bitter principle resembles to some extent colocynthin, and the name "*trichosanthin*" is proposed for it. The fruits when being burnt, and when decomposing in moist situations, give off large quantities of ammonia.

The green pulp in the interior of the fruit in which the seeds are embedded, contains a colouring matter which has more of the red in its fluorescence than chlorophyll, and its spectrum shows a different arrangement of bands than is seen in the usual green colouring matter of plants. Prof. Michie Smith (*Proc. Roy. Soc. Edin.* 1890), comparing the absorption spectra of this colouring matter with chlorophyll, finds in the former two very dark bands, one in the red extending from near C to about half way between C and D, the other in the yellow on the more refrangible side of D. There are two other fainter bands, one on each side of E. The action of hydrochloric acid and ammonium sulphide upon the colouring matter alters the spectrum in a characteristic manner that completely distinguishes it from chlorophyll.

Toxicology.—Roxburgh informs us that the fruit is reckoned poisonous. The Madras Chemical Examiner (1888) reported: "A woman who is said to have eaten the seeds (fruit?) of this plant with suicidal intent, suffered from vomiting, purging, and griping, and died collapsed. No alkaloid was found in the viscera, and a portion of the fruit was found non-poisonous with a guinea-pig."

TRICHOSANTHES DIOICA, *Roxb.*

Hab.—Throughout the plain of North India, Guzerat to Assam, Bengal.

TRICHOSANTHES CUCUMERINA, *Linn.*

Fig.—*Rheede Hort. Mal. viii., t.* 15. Sabino (*Port.*), Kalpert (*Dutch*).

Hab.—Throughout India and Ceylon. The plant in fruit.

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Vernacular.—Jangli-chichonda, Palwal (*Hind.*), Patol, Bon-patol (*Beng.*), Rán-parval, Karu-parval (*Mar.*), Parwar (*Guz.*), Kattup-pepudal (*Tam.*), Chyad-potta (*Tel.*), Gwal-kakri (*Punj.*), Dummaala (*Cingh.*), Padavalam (*Mal.*).

History, Uses, &c.—In Northern India, Bengal and Guzerat the fruit of *T. dioica* is considered to be the Patola of Sanskrit writers, and in Western and Southern India, where *T. dioica* is not found, *T. cucumerina* is used as Patola. Patola or Patolaka, "shaped like a muscle shell," is a medicine in great repute amongst the Hindus as a febrifuge and laxative in bilious fevers, the decoction of the whole plant being administered in combination with other bitters. It is also considered to purify the blood and remove boils and skin eruptions; aromatics may be added to the decoction. The following prescription from Chakradatta may be taken as an example:—Take of Patola, Tinospora, Cyperus, Chiretta, Neem-bark, Catechu, Oldenlandia, Root bark of Adhatoda, equal parts, in all two tolas (360 grains), and prepare a decoction which is afterwards to be boiled down to one-fourth, and taken in divided doses during 24 hours. The drug is also administered in combination with Turbith as a drastic purgative in jaundice and dropsy; the *Patoladya churna* is a compound purgative powder of this kind. Both of these plants are found in a wild and in a cultivated condition; for medicinal purposes, the wild plants are used, the cultivated fruits, though still bitter, are favourite vegetables with the Hindus and exert a mild aperient action when freely eaten.

Mahometan writers describe the plant as cardiacal, tonic, alterative and antifebrile, and say that it is a useful medicine for boils and intestinal worms. The author of the Makhzan remarks that the Hindus in obstinate cases of fever infuse 180 grains of the plant with an equal quantity of Coriander for a night, and in the morning add honey to it and strain the liquor; this quantity makes two doses, one of which is taken in the morning and one at night. In the Concan the leaf juice is rubbed over the liver or even the whole body in remittent fevers. In Guzerat the fruit of the cultivated *T. dioica* is

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steamed, stuffed with spices, fried in melted butter, and eaten with wheaten bread as a remedy for spermatorrhœa. Ainslie, under the name of *T. laciniosa*, notices the use of *T. cucumerina* as a stomachic and laxative medicine among the Tamools, and says it is the Patola of Southern India. Rheede gives the following account of its medicinal properties:—"Decoctum cum saccharo sumptum, digestioni confert, tormina intestinorum, ac alios ventris dolores sedat, phlegmata expectorat, pectoris angustiam tollit; febres minuit, humores attemperat, vermes enecat. Succus expressus idem præstat et vomitum provocat. Radicis succus ad quantitatem duarum unciarum epotus, valde purgativus est, in ipsa accessione februm quotidianarum ac quartanarum ex pituita provenientium, frigus vel diminuit vel in totum tollit, per vomitum scilicet: stipes in decocto datus phlegmati expectorando conducit: fructus quaquo modo sumpti tumores expellunt."

From our observation of the action of these plants we cannot find that they differ in any way from colocynth; like that drug they require to be combined with aromatics to prevent griping. Their febrifuge action appears to depend upon their purgative properties.

Description.—*T. dioica*—Stems twining, more or less woolly and scabrous. Leaves 3 by 2 in., harsh, sinuate-dentate, not lobed; petiole ¾ in.; tendrils 2-fid. Male peduncles in pairs. Calyx-tube 1¾ in., narrow. Fruit 2 to 3½ in., oblong, acute, orange-red. Seeds ⅜ to ½ in., half-ellipsoid, compressed, corrugate on the margin. Plant diœcious.

T. cucumerina—Stems twining, more or less pubescent. Leaves 2 to 4 in., usually 5-lobed about half-way down, lobes obtuse, or if acute not acuminate; petiole ¾ in.; tendrils 2-fid. Male peduncles in pairs, often racemed. Calyx-tube 1 inch. Fruit 1 to 4 in., oblong, acute, red. Seeds ¾ to ½ in., half-ellipsoid, compressed, corrugate. Plant diœcious. (*Fl. Br. Ind.*)

MOMORDICA DIOICA, *Roxb.*

Fig.—*Wight Ic., tt.* 505, 506; *Rheede, Hort. Mal. viii.*, 12.

Hab.—Throughout India The tubers.

Vernacular.—Kirara, Dhár-karela (*Hind.*), Karantoli (*Mar.*), Palupaghel-kalung (*Tam.*), Agokara, Angakara (*Tel.*), Erimapavel (*Mal.*), Madahagala (*Can.*).

Uses, Description, &c.—The muricated fruit of this plant is called Váhasa by Sanskrit writers, that of the wild plant is extremely bitter, but under cultivation it loses much of its bitterness and is commonly used as a vegetable. The fruits burst irregularly when ripe showing the red arillus of the seeds, which are black, shining, and almost spherical. The plants are male and female, and have rather large yellow blossoms. The tubers of the female plant are the largest, and are used medicinally. Rheede says that the plant is truly cephalic, for mixed with cocoanut, pepper, red sandal, and other ingredients, and applied in the form of liniment, it stops all pains in the head. Ainslie notices the use of the root by Hindu doctors in the form of electuary in cases of bleeding piles, and in certain bowel affections connected with such complaints, the dose being about 2 drachms or more twice daily. In the Concan the juice of the root is a domestic remedy for the inflammation caused by the contact with the urine of the House-lizard. The roots, which often weigh a pound or more, much resemble a turnip, but are more elongated; they are of a yellowish-white colour, and marked externally with whitish, raised circular rings; the taste is astringent.

Chemical composition.—The air-dried roots lost 72·78 per cent. when heated to 100° C., and afforded 3·42 per cent. of ash. The ash contained a slight trace of manganese.

The coarsely-powdered roots were exhausted with 80 per cent. alcohol; from the resulting tincture most of the alcohol was distilled off, and the remainder allowed to evaporate by exposure to the air. During evaporation a deep yellow oily looking matter separated, and the liquid gelatinized. The alcoholic extract was somewhat bitter, and left an unpleasant metallic taste in the mouth. By the addition of water the extract was converted into a turbid orange yellow mixture, which was agitated with petroleum ether.

The petroleum ether extract was of a light yellow colour, soft, non-crystalline, and possessed a fragrant odour similar to that of methyl salicylate. In ether it was wholly soluble; and with the exception of a few white flocks it was also soluble in absolute alcohol, with acid reaction. In cold aqueous caustic soda it was insoluble, but when gently warmed a portion dissolved, and the liquid assumed a deep orange colour; the addition of an acid to the alkaline solution caused a milkiness: during digestion with the caustic soda solution a very fragrant odour was noticed. The agitation of an ethereal solution of the petroleum ether extract with dilute hydrochloric acid, afforded traces of an alkaloid.

The aqueous residue after treatment with petroleum spirit was agitated with ether. The ethereal extract was yellowish, soft, indistinctly crystalline, and had an odour similar to that noted in the petroleum ether extract. In water the extract was partly soluble with strongly acid reaction, and the solution gave marked indications of the presence of an alkaloid; with ferric chloride the solution gave a dirty violet-reddish coloration. The residue insoluble in water was yellowish, and partly soluble in ammonia with yellow coloration: the insoluble residue was whitish. The addition of acids to the ammoniacal solution caused the precipitation of white flocks.

The original aqueous solution after separation of ether was rendered alkaline with carbonate of soda and agitated with ether; the ethereal extract amounted only to a trace, but afforded indications of an alkaloid with the usual reagents: no special colour reactions were noted.

After separation of ether, the aqueous alkaline residue was acidified with acetic acid and agitated with acetic ether: the extract thus obtained was reddish, and partly gelatinized on evaporation: it was partly soluble in acetic acid, a turbidity being produced by dilution with water.

In order to ascertain whether a purgative principle was present or not, an alcoholic extract from 10 grams of the root was rubbed up with water and injected into a cat's stomach, no purgative action was produced, and with the exception of an

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attack of vomiting one hour and ten minutes after administration of the drug, no symptoms appeared to be induced.

MOMORDICA COCHINCHINENSIS, *Spreng.*

Fig.—*Bot. Mag.*, *t.* 5145.

Hab.—Bengal to Tenasserim, Deccan Peninsula, Canara. The seeds.

Vernacular.—Kakrol (*Hind.*, *Beng.*).

History, Uses, &c.—The seeds after the shells have been removed are fried and eaten either alone or with other food. (*Makhzan.*) They are considered to be good for cough and pains in the chest. Powdered they form one of the ingredients of the hot stuff known as *Jhál* in Bengal, which, mixed with melted butter, is given to women immediately after parturition, and daily for a few days afterwards. *Jhál* is believed to act as a stimulant, destroying the excess of phlegmatic humours which are supposed to be produced in the body after delivery. (*C. L. Bose.*) A plaster made with the roots is said to promote the growth of the hair, and prevent its falling off. The plant is called in Sanskrit Karkataka, from the resemblance of the seeds to the shell of a crab. This plant is the *Muricia cochinchinensis* of Loureiro, who says that the berries are used for colouring food, and that the seeds and leaves are aperient and abstergent and useful in hepatic and splenic obstructions, in unhealthy ulcerations, lumbago; and externally in *procidentia uteri et ani*, fractures and luxations of the bones.

Description.—The seeds are $\frac{7}{8}$ by $\frac{5}{8}$ of an inch in diameter, and $\frac{1}{5}$ of an inch thick, ovate, compressed, black; corrugated on the margins and sculptured on the faces. The shell is fragile, and encloses an oily kernel.

Chemical composition.—Kakrol seeds deprived of their husks yielded 43·74 per cent. of a slightly greenish oil when treated with light petroleum ether. The oil possessed very powerful siccative properties; smeared in a thin layer on a glass plate,

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and exposed to a temperature of 100° C., in the course of an hour the oil assumed a translucent white appearance, and could be scraped off the glass as a white powder which, when boiled with petroleum ether, yielded only a trace of soluble matter, consisting of oil. Exposed to the air without being heated, in 24 hours a thin layer presented numberless little white cauliflower like masses, while a portion of the oil assumed an arborescent pattern on the glass. After saponification of the oil, and decomposition of the soap, the separated fatty acids had a melting point of 48°—49° C.

In addition to oil, a very slightly bitter glucoside was present, which afforded no special colour reactions with reagents.

MOMORDICA CHARANTIA, *Linn.*

Fig.—*Bot. Mag., t.* 2455; *Wight Ic., t.* 504; *Bot. Reg., t.* 980.

Hab.—Throughout India. The fruit.

Vernacular.—Karela (*Hind.*), Káralá (*Mar.*), Pava-kai, Pávakkapchedi (*Tam.*), Kákara-chettu (*Tel.*), Karala (*Beng.*).
Muricated var., Uchchhe (*Beng.*), Hagala (*Can.*).

Description, Uses, &c.—There are two chief varieties differing in the form of the fruit, the one being longer and more oblong, and the other smaller, more ovate, muricated and tubercled. There are besides many intermediate gradations. The fruit is bitter but wholesome, and is eaten by the natives. It requires, however, to be steeped in salt water before being cooked; the smaller variety is most esteemed. (*Drury.*) From Rheede, Wight and Gibson we learn that the Hindus use the whole plant combined with cinnamon, long pepper, rice and the oil of *Hydnocarpus Wightiana*, as an external application in scabies and other cutaneous diseases. The fruit and leaves are administered as an anthelmintic, and are applied externally in leprosy. One-eighth of a seer of the juice of the leaves is given in bilious affections, as an emetic and purgative, alone or combined with aromatics; the juice is rubbed in, in

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burning of the soles of the feet, and with black pepper is rubbed round the orbit as a cure for night blindness. The Sanskrit name is Káravella, the muricated variety is called Sushavi, and bears the synonym Kándira or "armed with arrows." The author of the *Makhzan-el-Adwiya* describes the fruit as tonic and stomachic, and says that it is useful in rheumatism and gout, and in diseases of the spleen and liver; he also mentions its anthelmintic properties. He points out that some have erroneously supposed it to be identical with the Katha-el-himár of the Arabs, which is a violent purgative. Drury has the following description of *M. Charantia*:—"Climbing, stem more or less hairy; leaves palmately 5-lobed, sinuate, toothed, when young more or less villous on the underside, particularly on the nerves; peduncles slender, with a reniform bracteole about the middle, female with it near the base; fruit oblong or ovate, more or less tubercled or muricated; seeds with a thick notched margin and red aril; flowers middle-sized, pale yellow." In the rainy season the plant may be seen in almost every garden in India. The fruit is also offered for sale in the market, and when well cultivated attains the size of a cucumber.

MOMORDICA CYMBALARIA, *Fenzl.*

Fig.—Lyon *Med. Jurisp. for India, p.* 200, *f.* 14.

Hab.—Deccan Peninsula, Mysore, Concan. The tubers.

Vernacular.—Kadavanchi (*Mar.*).

History, Uses, &c.—The whole plant is acrid; it is mentioned here as a number of the tubers were forwarded to the Chemical Analyser to Government, Bombay, from Satara, as having been found in the possession of a person suspected of administering drugs to procure abortion. Our specimen was grown from one of these tubers. Dr. Lyon, the Chemical Analyser, informs us that on reference to the records of his office he finds that the Kadavanchi tubers have been three times sent to him within the last four years as having been used to procure abortion. In 1889, the tubers were again

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forwarded to Dr. Barry, Acting Chemical Analyser, in connection with a case of abortion.

Description.—Root tuberous, ovoid; the tubers had the odour of cucumbers, and examined under the microscope, the central portion was seen to consist of starch cells, between this portion and the epidermal layer irregular masses of a resinous substance were observed; leaves 1—2 inch broad, 5-angular or slightly 5-lobed, middle lobe not elongated, glabrous or slightly pubescent, often punctulate on both surfaces, dentate: petiole ½—1½ in. Male raceme 1—2 in., with usually only two to four flowers; calyx-lobes lanceolate; petals ¼ in., white; filaments two, one 2-fid, one 3-fid, so each with one anther-cell; filaments inserted near the top of the calyx tube, anthers completely exsert. Female peduncle ¾—2 in., one flowered, ebracteate (the male peduncle has a minute bract). Fruit ¾—1 by ¼ in. Seeds ⅙—¼ in., few, shortly obovoid, smooth, shining. (*Fl. of Brit. India.*) The fruit has eight prominent ribs, and is covered with silky hairs; while still green, it dehisces into four parts, and discharges its seeds, which are obovoid, dark brown, slightly warty, as large as a small peppercorn, and with a prominent hilum.

Chemical composition.—A bitter glucoside was isolated from the portion of the alcoholic extract of the tubers soluble in water. It was almost insoluble in ether, and was precipitable from its aqueous solution by tannin and alkaloidal reagents. With strong sulphuric acid it turned bright red and the colour gradually changed to purple, which remained for several hours.

A yellow acid resin of very acrid properties was present in the tincture, together with a saccharine principle.

A tuber weighing 2 grams was incinerated, the ash amounted to 6 per cent.

LUFFA ACUTANGULA, *Roxb. Var. amara.*

Fig.—*Bot. Mag.* 1638.

Hab.—Throughout India. The fruit and vine.

Vernacular.—Karela-toria, Karvi-turai (*Hind.*), Kadu-sirola, Kadu-dorka (*Mar.*), Ghosha-lata, Tito-torai (*Beng.*), Pé-pirkkam

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(*Tam.*), Chedu-bira, Verri-bira (*Tel.*), Kadvi-ghisodi (*Guz.*), Hire-balli (*Can.*).

History, Uses, &c.—This plant is called in Sanskrit Koshataki, a general name for the genus Luffa, from *kosha*, the cocoon of a silk-worm, and in allusion to the way in which the seeds are enclosed within a fibrous network. The names Dalika and Ghoshaka appear more particularly to appertain to this species. The Hindus apply the juice of the immature gourd, which has been slightly roasted, to the temples to cure headache, and administer an infusion of the ripe fruit as a vomit and purge. Roxburgh notices the cathartic and emetic properties of the fruit. In the *Pharmacopœia of India* the plant is described as a bitter tonic and diuretic, and is recommended in enlargements of the spleen on the authority of Dr. J. A. Green and Mr. J. C. Dickenson. The juice of the leaves is used as an external application to sores, and the bites of venomous animals, and the pulp of the fruit is administered internally in the latter class of cases to cause vomiting and purging, just as colocynth is used where that plant is abundant. The dried fruit is powdered and made into a snuff for those suffering from jaundice, and the root with equal parts of *Hibiscus Rosa-sinensis* root and *Hemidesmus* is given with milk, cumin and sugar in gonorrhœa.

Description.—The vine of *L. amara* resembles that of the cultivated plant. The fruit is smooth, from 3 to 5 inches long, ovoid, marked with ten prominent, sharp longitudinal ridges; at the apex is a small operculum rather more than half an inch in diameter, which is deciduous. Internally it is filled with white spongy pulp, of a cucumber odour. The seeds are grey and marked with small irregular black prominent specks. The leaves are bitter, the fruit less so.

LUFFA ECHINATA, *Roxb.*

Fig.—*Lyon, Med. Juris. for India, p.* 201.

Hab.—Guzerat, Sind, Bengal, Dacca. The fruit.

Vernacular.—Kukar-lata, Bindál, Ghagar-bel, Deodáil (*Hind.*), Kukar-vel, Vápala (*Guz.*), Deodangri, Deotádi (*Mar.*), Deodáli (*Can.*).

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History, Uses, &c.—This plant is used medicinally in most parts of India. In the Nighantas it bears the following Sanskrit names: Devadáli, Vrata-kosha, Devatádi, Gará, Jimúta, Taraki, Veni, Jálani, and Akhu-visha-ha; it is described as expelling bile, phlegm, and removing piles, swellings, jaundice, phthisis, hiccough, worms and fever, and acting as an emetic.

In Guzerat the fruit is well known as Vápala-bij, a name derived from the Sanskrit *vápa*, "weaving," in allusion to the cocoon-like network in which the seeds are enclosed. The drug is a frequent ingredient in the compound decoctions which are prescribed for bilious fevers. In the Concan a few grains of the bitter fibrous contents of the fruit are given in infusion for snake-bite and in cholera after each stool; in putrid fevers the infusion is applied to the whole body, and in jaundice it is applied to the head and also given internally; the infusion has also a reputation as a remedy for colic. We have not met with any notice of the medicinal use of this plant in European works on the Materia Medica of India.

Description.—The stems are herbaceous, scandent, five-sided, slightly hairy; tendrils two cleft; leaves generally five-lobed, somewhat hairy, margins scallop-toothed; petioles as long as the leaves, ribbed; fruit oval, the size of a nutmeg, armed with numerous long, rather soft, diverging bristles, obscurely divided into three cells by a network of dry fibres, and opening at the top with a perforated stopple, which falls off when the seeds are ripe; seeds about 18, ovate, compressed, black and scabrous; testa very hard; kernel white. The fibrous substance in which the seeds are enclosed is intensely bitter.

Chemical composition.—The air-dried fruit deprived of seeds as much as possible was agitated with 80 per cent. alcohol: the greater part of the spirit removed by distillation, and the remainder allowed to evaporate by exposure to air. During spontaneous evaporation the tincture gelatinized. When the extract no longer smelt of alcohol it was gently warmed on the water bath, water added, and when cold the turbid mixture

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repeatedly agitated with ether. The ether was much coloured; gelatinous flocks separated during agitation.

The ethereal solution contained a large amount of chlorophyll, and after evaporation of the ether, the residue became partly crystalline. The extract was repeatedly treated with light petroleum ether, which removed some waxy and much colouring matter, and a crystalline principle, appearing as needles and stellate masses under the microscope, which was not further examined. The dark residue insoluble in petroleum ether was then boiled with water; the aqueous solution was slightly yellow, became turbid on cooling, and possessed an extremely bitter taste. This aqueous solution was agitated with ether; on spontaneous evaporation a yellow transparent varnish was left, destitute of any crystalline structure. The extract treated with water afforded a white curdy precipitate with tannic acid: no precipitate with Mayer's reagent: with ferric chloride it afforded a slight greenish coloration; after boiling with dilute sulphuric acid, the solution readily reduced Fehling's solution. This principle would appear to be allied to, if not identical with, *colocynthitin*.

Its physiological action was tried in the following experiment:—0·0296 gram. was dissolved in a few drops of alcohol and warm water, and injected into a full grown, fasting cat's stomach at 10-50 a. m.

11-20 a. m.—Vomited several times, first contents of the stomach, and then white frothy mucus, not tinged with blood.

12-0 noon.—Passed a solid stool: lying on its side breathing slow.

1-40 p. m.—Passed a semi-solid stool tinged with blood; pupils somewhat dilated; now and again contraction of abdominal muscles: uneasy, chiefly on its side, but shifts its position frequently.

2-45 p. m.—Pupils widely dilated: less of power in hind legs, unable to stand: appears to have some difficulty in raising its head, which it keeps between its fore paws, which are extended; expression anxious.

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2-55 p. m.—Slight convulsive movements of hind legs; breathing very shallow; pupils widely dilated; position as before.

2-57 p. m.—Marked convulsive movements of hind legs; breathing spasmodic and loud.

3-4 p. m.—Spasmodic gasps at intervals of about 10 seconds.

3-15 p. m.—Died; no further convulsive movements.

Death thus resulted in 4 hours 25 minutes after introduction of the drug into the stomach, and only one stool was passed which could be ascribed as being due to its action.

Post-mortem examination 20 minutes after death:—Both lungs pale and collapsed; no fluid in pleural cavity.

Heart contracted, and empty; no clots.

Stomach contained frothy glairy mucus, and a deep yellow fluid, walls darkly congested; no effusion of blood.

Liver congested. Spleen normal. Kidneys, central portions lightly congested.

Intestines—Rectum highly congested, with bloody adherent mucus; the lower portion of the jejunum comparatively slightly congested in patches, the upper portion more deeply congested, until the duodenum is reached, when the whole of the gut was of a dark claret colour, from uniform congestion. The ilium was wholly free from congestion and was bile stained.

The gelatinous flocks which separated on agitating the aqueous alcoholic extract with ether had the following properties:—By boiling with water an opalescent solution was obtained, which was filtered. The insoluble residue on the filter was soluble in boiling absolute alcohol, on concentration microscopic needles, rods, and plates separated. This residue was not further examined; it did not exceed a trace. The aqueous filtrate gelatinized before it was quite cold. A portion was evaporated to dryness and boiled with absolute alcohol, when with the exception of a trace of insoluble matter, it wholly dissolved, forming a yellowish and bitter solution. On spontaneous evaporation opalescent masses separated on the sides of the beaker, and the solution formed a jelly. On completely evapo-

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rating off the alcohol, brittle yellowish flakes were left. In ammonia the principle dissolved forming a deep yellow solution; on the addition of acids the colour was discharged, slightly yellowish flocks being precipitated, which redissolved in alkalies with a deep yellow coloration: with tannin no precipitate was produced. Fröhde's reagent gave a yellow colour in the cold, becoming emerald green on heating, and changing on cooling to blue, green, and finally to yellow. Nitric acid gave a yellow colour. Mayer's reagent, after acidulation with sulphuric acid, gave no precipitate. Concentrated sulphuric acid gave a deep yellow: on the addition of bichromate of potash there was no special colour reaction. On boiling with dilute sulphuric acid, yellow flocks separated, only slightly soluble in boiling water, and not gelatinizing; slightly soluble in ether; dissolving in alkalies with a deep yellow coloration and reprecipitated in gelatinous flocks by acids. The aqueous acid filtrate after digestion with Barium carbonate was slightly bitter, and precipitated an alkaline copper solution on boiling.

The gelatinizing properties of this principle appear to be very marked. ·1016 gram when dissolved in 100 c. c. of boiling water, gelatinized when the temperature fell to 35° C., so that the beaker containing the solution could be inverted. We have provisionally termed this principle "*luffein*," and we think it not unlikely that it will be found in the fruit of most other plants of the same and allied orders; it differs from pectin, vegetable mucilage, &c., by being soluble in alcohol. From the original aqueous solution after dissolved ether had been expelled, agitation with acetic ether yielded an extractive, highly bitter, which afforded reactions similar to those of colocynthin.

We were unable to obtain the principle in a crystalline form.

The seeds contain a bland fluid oil free from bitterness, and which possesses some siccative properties.

Toxicology.—Dr. Burton Brown (*Punjab Poisons*, p. 206,) notices the use of the fruit as an abortifacient. In 1887, Dr.

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Kirtikar recorded (*Trans. Bomb. Med. and Phys. Soc.*) a case of poisoning with symptons resembling those of cholera, after the administration of one fruit as a purgative; this dose proved fatal. The drug must therefore be used with great caution.

CEPHALANDRA INDICA, *Naud.*

Fig.—*Wight Ill.*, *t.* 105; *Hook. Ic. Pl. I.*, *t.* 138.

Hab.—Throughout India.

Vernacular.—Kunduri (*Hind.*), Telakucha (*Beng.*), Kovai (*Tam.*), Rán-tondla (*Mar.*), Gholi (*Guz.*), Tonde-konde (*Can.*).

History, Uses, &c.—This plant is called in Sanskrit Vimba, Vimbaja, Tundkéri and Tundika; it has a scarlet fruit, and Indian beauties are descriped as Vimboshta, "red or cherry-lipped," by poets and story tellers. The root and juice of the leaves is used medicinally; the wild fruit is very bitter, but that of the cultivated form is sweet and is much used as a vegetable. In Hindu medicine the juice of the tuberous root is used as an adjunct to the metallic preparations prescribed in diabetes in doses of one tola (180 grs.) every morning. Dutt states that he has known several patients who were benefited by its use. Ainslie notices its use in southern India, and says that the juice of the leaves is applied to the bites of animals, Moodeen Sheriff states that in the bazars of the south the root is sold as a substitute for Caper root. In the Concan the root pounded with the juice of the leaves is applied to the whole body to induce perspiration in fever, and the green fruit is chewed to cure sores on the tongue. We have found the deep green leaves useful as a colouring agent in preparing Savine ointment from the essential oil.

Description.—Fruit bitter, fleshy, cylindrical, smooth, green, with ten white stripes when unripe, in which state it is used when cultivated and free from bitterness; when ripe scarlet, indehiscent, about 2 inches long by one in diameter; seeds numerous. The natural form of the root is a long tapering tuber, but it is often much deformed when growing in

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stony ground and becomes crooked and knotty. It is perennial and often attains a considerable size, but the average diameter in the wild plant is from 1 to 2 inches at the thickest part a little below the crown. Externally the root is of a pale yellowish-brown colour, with indistinct circular constrictions and longitudinal furrows. The transverse section is yellow with distinct medullary rays. The root is traversed by numerous bundles of stout woody fibres; when wounded a clear juice exudes having a cucumber odour, which dries into an opalescent gum. The root has an acid and astringent taste, and is not quite free from bitterness.

Chemical composition.—The sliced tubers were dried at a low temperature, reduced to powder, and the powder sifted from woody fibre. Dried at 100° C. the powder lost 6·76 per cent. of moisture. The ash amounted to 15·52 per cent., there was nothing special to note regarding its composition; it did not contain any manganese. The powdered tubers were exhausted with 80 per cent. alcohol; the tincture was of a yellow colour: on concentration resin and oily particles separated; the addition of water caused a turbidity; the turbid solution was heated to drive off the last traces of alcohol: the liquid had a strongly acid reaction. To the turbid acid solution more water was added and the liquid agitated with ether. The separated ether was agitated with dilute hydrochloric acid; the acid solution gave indications of the presence of an alkaloid. The separated ether left on evaporation a soft yellowish non-crystalline residue, possessing a fragrant odour. This extract was insoluble in alkalies, easily soluble in alcohol, ether and benzol. The aqueous solution after separation of ether was rendered alkaline with carbonate of soda, and agitated with ether. The hydrochloric acid solution referred to above was treated in a similar manner, and the separated ethers mixed. The mixed ethereal solution left on spontaneous evaporation a soft yellow non-crystalline residue, possessing a fruity odour, which was considerably increased by the addition of dilute sulphuric acid. In dilute acids the extract was partly soluble; the acid solution gave a precipitate with all alkaloidal

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reagents. The special properties of this alkaloid will be considered later. The principle insoluble in acids had the properties of a resin.

The alkaline aqueous solution was subsequently agitated with chloroform, and then with amylic alcohol. In both cases extracts were yielded partly soluble in dilute acids, the solutions affording precipitates with alkaloidal reagents. From colour reactions and the physical properties of these alkaloids, they appeared to be similar to the one first extracted by ether. The three acid solutions were consequently mixed, agitated with amylic alcohol, which removed a trace of resin; the acid then neutralized with carbonate of soda, and the solution agitated with fresh amylic alcohol. On evaporating off the amylic alcohol, a varnish-like residue was left, easily soluble in alcohol and amylic alcohol, but less readily dissolved by ether chloroform. In water the extract was only very slightly soluble; in dilute sulphuric acid it was not wholly soluble, a trace of resin being left. The acid solution was strongly bitter. With alkaline carbonates it gave a white precipitate; with platinic and auric chlorides amorphous precipitates: it also yielded precipitates with phosphomolybdic acid, potassio-mercuric iodide, teriodide of potassium, picric acid, &c. With concentrated nitric acid it afforded no colour reaction in the cold, but on the application of a gentle heat a slight yellow colour was developed: concentrated hydrochloric acid gave no reaction in the cold or on heating; concentrated sulphuric acid gave a light brown tint in the cold, which became reddish-brown on heating. Fröhde's reagent gave a lilac tint in the cold, which became reddish on heating and blue as the liquid cooled. Bichromate of potassium and sulphuric acid afforded no special colour reaction; ferric chloride gave no colour reaction. This alkaloid was only present in very small amount, hardly more than a marked trace.

Ether chloroform and amylic alcohol also extracted a golden brown resin, insoluble in alkaline carbonates, easily soluble in caustic soda, and less readily dissolved by ammonia. In amylic alcohol the resin was more easily soluble than in ether or

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chloroform. From its alkaline solutions it was precipitated by dilute acids in yellowish flocks.

After agitation with amylic alcohol the alkaline solution was precipitated with plumbic acetate; on decomposing the lead salt with hydro-sulphuric acid an organic acid was obtained, which afforded the reactions of citric acid. The liquid after separation of the lead precipitate was treated with hydro-sulphuric acid, the filtrate evaporated to a syrup, and heated for some hours on the water bath, on diluting with water a strongly acid solution was obtained, the acidity of which was not due to acetic acid; the nature of this organic acid was not determined.

A principle which easily reduced an alkaline cupric solution was also present in the liquid.

The tubers contained starch; they did not afford any tannic matter.

ZEHNERIA UMBELLATA, *Thwaites.*

Fig.—*Rheede Hort. Mal. viii., t.* 26.

Hab.—Throughout India. The fruit and roots.

Vernacular.—Tarali (*Hind.*), Kudari (*Beng.*), Gometta (*Mar.*), Tid-dánda (*Tel.*), Karivi-valli (*Mal.*).

History, Uses, &c.—This plant is the Gointhi or Karivi-valli of Rheede, who notices its use by the Hindus of Malabar as a depurative, useful in gonorrhœa, dysuria and diseases supposed to arise from adust bile in the blood. The Portuguese call it *Popinho do Patare* and the Dutch *Karlingen.* Roxburgh describes it under the name of *Momordica umbellata,* and notices the use of the fruit and roots as a medicine by the natives, but does not give any particulars. The root is usually prescribed as a *Paushtika* or invigorating medicine, combined with roasted onions, cumin, sugar and melted butter, forming a *ghritapaka* or medicated butter; sometimes the root is given beaten up with milk and sugar, to which cumin is added if it is prescribed as a remedy for gonorrhœa.

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In the Concan the juice of the leaves is applied to parts which have become inflamed from the application of the juice of the marking nut (*Semicarpus Anacardium*).

Description.—From the *Flora of British India* it will be seen that this is a very variable plant common on hedges throughout India, Ceylon, Malaya, China and North Australia. It is diæcious, and has a root consisting of many pendulous tubers.

The leaves are shortly petioled, cordate or sagittate or hastate at the base, the lobes longer than the petiole, 3 to 5-lobed, or palmately 5-partite, sinuate and sharply toothed; male flowers umbelled or shortly racemose at the apex of a long slender peduncle; female on a different plant, solitary, short-peduncled; berry oval or oblong, size of a pigeon's egg, smooth, red when ripe. The tubers are of an irregular, elongated form, usually about one inch in diameter; brown externally, white internally; they have a faint nauseous taste.

CORALLOCARPUS EPIGÆA, *Hook. f.*

Fig.—*Wight Ic., t.* 503.

Hab.—Punjab, Sind. Guzerat, Deccan. The tubers.

Vernacular.—Akás-gadda, Chhilihinda, Garaj-phal (*Hind.*), Karvi-nai (*Guz.*), Akásha-garudan, Gollan-kovaik-kizhangu (*Tam.*), Akásha-garuda-gaddalu, Nága-donda (*Tel.*), Akasha-garuda-gadde (*Can.*), Siva-linga (*Mar.*).

History, Uses, &c.—This plant is called in Sanskrit Chhilihinda, Pátála-garuda and Maha-mula or "great-root." It is described in the Nighantas as very strengthening, and a begetter of phlegmatic humors, and a valuable remedy for rheumatism. Ainslie remarks that the Vytians hold it in great estimation, and prescribe it in the latter stages of dysentery, and old venereal complaints. It is usually administered

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in powder, the dose being about one drachm in the 24 hours, and continued for eight or ten days together; this quantity generally produces one or two loose motions every day. It is also considered anthelmintic. For external use in chronic rheumatism it is made into a liniment with cumin seed, onions, and castor oil. In the Deccan and Mysore the root has a repute as a remedy for snake-bite; it is administered internally and applied to the bitten part. This plant is used in India as a substitute for the Lúf or Lúfa of the Arabian and Persian physicians, the *Bryonia dioica* of more Western countries, and the ἄμπελος λευκη of Dioscorides. The Arabic word *Lúfa* is probably a corruption of λευκη.

The vernacular names are mostly compounds of Ákás, "the sky," and Gadda, "a tuberous root." The Marathi name signifies "the linga of Síva," and is an allusion to the shape of the fruit.

Description.—The root is a turnip-shaped tuber, sometimes weighing as much as 5 to 6 pounds. Externally it is yellowish white and marked with raised circular rings; the taste is bitter, mucilaginous, and subacid. When cut the tuber exudes a viscid juice, which soon hardens into an opalescent gum.

Chemical composition.—The bitter principle of *C. epigæa* can be removed from an aqueous extract, previously separated from mucilage by treatment with alcohol, by agitation with chloroform or amylic alcohol. It is a whitish amorphous mass soluble in water and spirit, and very slightly soluble in ether. Its solution is precipitated by tannin and not by either basic or neutral plumbic acetate. It is coloured reddish-brown by sulphuric acid, and after several hours assumes a purplish hue owing to the gradual deposition of a black powder. The purple colour is not so well marked as that afforded by *trichosanthin* and the bitter principle of *Momordica Cymbalaria.* It dissolves in nitric acid without colour. This bitter principle is the same as *bryonin,* which has been found by Walz in common

Bryony root, and we have been able to confirm this by finding in the decomposition products two resinoid bodies differing in their solubility in ether. Bryonin is a glucoside resolved by boiling with dilute sulphuric acid into glucose and two amorphous bodies, bryoretin, soluble in ether, and hydrobryoretin, insoluble in ether but soluble in alcohol

$$C^{48} H^{84} O^{21} = C^{21} H^{35} O^{7} + C^{21} H^{37} O^{8} + C^{6} H^{12} O^{6}.$$

Bryonin Bryoretin Hydrobryoretin Glucose.

We have been unable to find a second bitter principle in these tubers, for on washing the lead precipitate of the extract until free from bryonin, and treating the lead compound with hydrogen sulphide, the solution was free from bitterness, and the evaporated residue was not coloured by sulphuric acid. The tubers contained much starch, a little resin, and 10 per cent. of white saline ash.

BRYONIA LACINIOSA, *Linn.*

Fig.—*Wight Ic., t.* 500; *Rheede Hort. Mal. viii.*, 19.

Hab.—From the Himalaya to Ceylon, Pegu. The plant.

Vernacular.—Bajguriya, Ghargu-náru (*Hind.*), Kavadori, Kavale-che-dole (*Mar.*), Nehoemeka (*Mal.*), Lingatondi (*Can.*).

History, Uses, &c.—This plant appears to be the Baja of Sanskrit writers, and is said to have been used in Vedic times to frighten away evil spirits; it is still known in Hindi as Bajguriya or "Baja beads." It is also probably one of the plants included by the name Ghantáli (see *Mukia scabrella*). Rheede (viii. 19) calls it Nehoemeka, and says that the Portuguese call it *Nhola*, and the Dutch *Slitten*. The vernacular name *Ghargu-náru* signifies a string of ankle bells, such as are worn by dancing girls. These bells have vertical slits in them, resembling the white vertical lines on the fruit of this Bryony. The juice of *B. laciniosa* is given with milk, honey, or sugar in bilious attacks, and in the commencement of fevers when there is flatulence and constipation; it clears

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out the bowels, and is often sufficient without further treatment in cases of this kind which arise from over eating.

Description.—A climbing plant with a smooth stem common in hedges. The leaves are palmately 5-lobed, more or less deeply divided, segments oblong, lanceolate acuminated, serrated; petioles muricated, upper surface of the leaf thickly studded with white, jointed, calcareous hairs, rising from a calcareous areola; male and female flowers, in the same axils, the peduncles of the male flowers, which are numerous, remaining until the fruit ripens; flowers small, pale yellow; fruit round, smooth, marked with white vertical stripes, the size of a marble, red when ripe, with the exception of the stripes, which remain of a dead white. The whole plant is very bitter.

Chemical composition.—An alcoholic extract of the plant was made with 84 per cent. alcohol, water added, and the turbid mixture agitated with light petroleum ether, which removed colouring matter and a small amount of fat.

After separation of the petroleum ether the bright yellow aqueous solution was agitated with chloroform. The chloroform extract was yellowish, non-crystalline and very bitter. Treated with warm water the greater part dissolved, the aqueous solution on evaporation left a residue which gave a white precipitate with tannic acid, and which reduced an alkaline copper solution after boiling with dilute sulphuric acid. Generally the reactions afforded by this bitter principle were similar to those described as being produced by bryonin. With concentrated sulphuric acid a brownish red coloration was produced; whereas in Watts' *Dictionary of Chemistry*, 1st Edition, sulphuric acid is stated to dissolve bryonin "forming a blue liquid which changes to green." Gmelin, however, (*Handbook of Chemistry*) states that it is coloured red brown by oil of vitriol. We have tested the action of concentrated sulphuric acid on a specimen of bryonin obtained from Dr. Schuchardt, and find that no such reaction as is described in Watts' *Dictionary* occurs, the colour tint being brownish red.

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MUKIA SCABRELLA, *Arn.*

Fig.—*Wight Ic., t.* 501; *Rheede Hort. Mal. viii.*, 13.

Hab.—Throughout India. The plant in fruit.

Vernacular.—Agamaki (*Hind.*), Mosumúski (*Tam.*), Putenbudinga, Núdhosa (*Tel.*), Chiráti (*Mar.*), Mucca-piri (*Mal.*).

History, Uses, &c.—Ainslie gives *Ahilaykum* as the Sanskrit name of this plant in Southern India. This is evidently a corruption of अहिलेखन (Ahilékhana), "marked like a snake," in allusion to the vertical white stripes upon the fruit. Another Sanskrit name which appears to have been applied to this plant as well as to *Bryonia laciniosa* is Ghantáli, which signifies a row or string of bells (Ghantá-áli), such as are worn by dancing girls, and which have vertical slits resembling the vertical marks on the fruit of these plants. Ainslie informs us that this herb is considered to be gently aperient and stomachic, the infusion being given in doses of half a cupful twice daily. It is used for the same purposes now, and it enters into mixtures frequently given to children. Rheede mentions its use as a diuretic.

Description.—Plant hispid and scabrous; tendrils simple; leaves cordate, lobed or angled; flowers short-peduncled, male numerous, fascicled; female, 1 to 4, small, campanulate, yellow; berry globular, size of a pea, scarlet when ripe, marked with white vertical lines, smooth or sprinkled with a few bristly hairs. Plant and fruit bitter. The fruits ripen in October to December.

ZANONIA INDICA, *Linn.*

Fig.—*Wight Ill., t.* 103; *Lam. Ill., t.* 816; *Rheede Hort. Mal. viii., tt.* 47, 48, 49.

Hab.—Assam, E. Bengal, W. Peninsula, Ceylon.

Vernacular.—Chirpota (*Hind., Mar.*), Penar-valli (*Mal.*).

History, Uses, &c.—In the Nighantas this plant bears the Sanskrit names of Chirpota, Dirghapatra, Kuntali and Tiktaka; it is described as cold, dry, and aperient, and beneficial in asthma and cough. Rheede (viii., 47, 48, 49,) calls it Penar-valli, which appears to be a corruption of the Sanskrit Pinda-valli; he says that the Dutch call it *Naet-klim* and the Portuguese *Fruita bandoliera.* The latter name is given to the fruit from its resemblance to the leather cases called bandoleers, each containing a charge of powder, of which every musketeer wore twelve, suspended by a shoulder belt. In Malabar a bath made by boiling the leaves in water is used to remove the nervous irritation caused by boils, and an antispasmodic liniment is made by pounding the leaves with milk and butter. In Ceylon the plant is used as a febrifuge.

Description.—Leaves 6 to 8 by 3 to 4 inches, usually acute; petiole one inch; male flowers very small, pedicels ⅛ to ¼ inch; female flowers, including the ovary, ½ inch; ovary early becoming one-celled by the separation of the three fleshy placentas; seeds much compressed, hardly 1-10 inch thick; capsule large, like a candle extinguisher.

ECBALLIUM ELATERIUM, *A. Richard.*

Fig.—*Bentl. and Trim., t.* 115. Squirting Cucumber (*Eng.*), Concombre d'âne (*Fr.*).

Hab.—Europe, Northern Asia. The fruit.

Vernacular.—Khiyár-i-khar, Katha-el-himar (*Pers., Arab.*), Kátri-indráyan (*Ind. Bazars*).

History, Uses, &c.—The fruit occasionally reaches India in a dry state. It is imported from Persia, and has evidently been gathered while immature, as the contents have not been discharged. *E. Elaterium* is reported to grow in abundance about Tiflis and on the banks of the river Kura, and in Georgian popular medicine, under the name of *Kitrana,* it has a good reputation as a remedy in malarial fevers. At a meeting

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of the Caucasian Medical Society in 1885, Dr. Minkevitch referred to the subject, and stated that the paroxysms may be arrested by the use of the drug, but the relief is only temporary, as they return in two or three weeks. Drs. Lisitzeff and Astvaturoff also stated that in Kakhetian popular medicine, *Kitrana* is used as a narcotic, and is believed to be specially serviceable in cases of hydrophobia. (*Pharm. Journ.*, Feb. 27th 1886, *from Med. Record.*) Elaterium does not appear to be known in Hindu medicine, but the Arabs and Persians are well acquainted with it. The former call the fruit Katha-el-himár (asses' cucumber), and the latter Khiyár-i-khar, which has the same meaning, or Khiarzeh (little cucumber). Haji Zein gives Ispheridagrion (σφαίριδιον ἄγρίον) as the Greek name. The author of the *Makhzan-el-Adwiya* describes it, and also the method of preparing elaterium. To prepare this he directs the fruit to be sliced, thrown upon a strainer and pressed, the pulp is then to be twice washed with water, and the deposit, which is thrown down from the water, collected and dried. It is then to be finely powdered and made into lozenges, with an equal weight of gum arabic or calamine, or half its weight of starch.* The Mahometan writers attach considerable importance to elaterium as a purgative of the diseased humours which they suppose to be the cause of a great number of diseases. They also use poultices made with the fruit, leaves, and root of the plant, and direct the juice of the fruit to be snuffed up the nose to purge the brain, and to be dropped into the ears in otitis. It is worthy of remark that the Hindus use their bitter and purgative cucurbitaceous fruits in the same manner. Elaterin injected subcutaneously acts on the nervous system, causing salivation, insensibility, tetanus and dyspnœa; large doses administered by the mouth cause gastro-enteritis and collapse.

Chemical composition.—The active principle, *Elaterin*, $C^{20}H^{28}O^{5}$, is best obtained by exhausting elaterium with chloroform. From this solution a white crystalline deposit of

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* Compare with Dioscorides περί ελατηριου and Pliny 20, 3.

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elaterin is immediately separated by addition of ether. It should be washed with a little ether and recrystallized from chloroform.

Elaterin forms hexagonal tables, insoluble in water, slightly soluble in ether, very soluble in alcohol. It gives a carmine colour with phenol and $H^2 SO^4$. (*Fresenius' Zeit. f. anal. Chem.* 17, 500; 24, 156.)

Several other cucurbitaceous plants are more or less in use medicinally. Among these we may mention **Modecca palmata**, *Lam.* (*Rheede Hort. Mal. viii.*, 20, 23), the juice of which with cocoanut milk is used as a pectoral in Malabar, and the roots as an ingredient in strengthening medicines (Paushtiks).

Trichosanthes nervifolia, *Linn.* (*Rheede Hort. Mal. viii.*, 16, 17,) is used in the same part of the country to drive away evil spirits. According to Ainslie, the root of **Rhynchocarpa fœtida**, *Schrad.*, is prescribed internally in electuary, in cases of piles, and in powder is sometimes ordered as a demulcent in humoral asthma. The root is about the size of a man's finger, light grey, and has a sweet mucilaginous taste. The Tamil name is Appakovay.

The seeds of **Ampelosicyos scandens**, *Thou.*, *Bot. Mag.* 2681, 2751-2, have been introduced into Bombay from Zanzibar as a vermifuge; they are flat and almost circular, about an inch and a half across; the external envelope resembles delicate basket work, and is very tough and strong; the kernel yields a quantity of bland oil. The entire fruit is from 2 to 3 feet in length and 8 to 10 inches thick, marked with deep longitudinal furrows, the inside is divided into from three to six cells, and often contains as many as 250 seeds.

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DATISCEÆ.

DATISCA CANNABINA, *Linn.*

Fig.—*Lam. Ill., t.* 823; *Sibth. Fl. Græc., t.* 960.

Hab.—Himalaya from Cashmir to Nepal; Sind. The herb and roots.

Vernacular.—Akalbar (*Hind.*), Bayr-bunja, Bhangjala (*Punj.*).

Uses.—Datisca is bitter and purgative, and is occasionally used in fevers and in gastric and scrofulous complaints. In Khagan the bruised root is applied to the head as a sedative, and Madden states that under the name *of Bujr Bunga* it is used medicinally in Kurnool. (*Stewart, Cleghorn.*) The plant may be administered in doses of from 5 to 15 grains in intermittents.

Description.—Stem 2—6 ft., stout, branching. Lower leaves 1 ft., pinnate; leaflets 7—11, 6 by 1½ in., petioled; upper much smaller and less divided; floral simple, 3 by 1¼ in. Pedicels often carrying linear bracts; anthers oblong, rather large; filaments very short; styles ¼ inch; capsule ⅓ by less than ⅓ inch (*Fl. Br. Ind.*), one-celled, opening at the apex; seeds numerous, striated, with a cup-like covering at the base.

Chemical composition.—The leaves and roots contain a glucoside, *Datiscin*, $C^{21}H^{22}O^{12}$, which may be obtained by exhausting them with alcohol, evaporating to a syrup, and precipitating the resin with water; from the decanted liquid crystals may be obtained, which should be re-dissolved in alcohol and the remaining traces of resin removed by repreciptation with water. Datiscin may then be obtained in colourless silky needles or scales, little soluble in cold water and only sparingly so in warm water and ether. The crystals are neutral and have a bitter taste; they melt at 180° C. (*Braconnot, Ann. de Chim. et. de Phys.* iii., 277; *Stenhouse, Ann. der Chem. u. Pharm.* xcviii., 106,) *quoted in Wurtz, Dict. de Chim.*, i., 1134.

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CACTEÆ.

OPUNTIA DILLENII, *Haw.*

Fig.—*Wight Ill.* 114. Prickly pear (*Eng.*).

Hab.—America. Naturalized in India. The fruit.

Vernacular.—Nágphani, Bidar (*Hind., Beng.*), Naga-kali (*Tam.*), Naga-dali (*Tel.*), Chappál-send, Vilayati-nevarung (*Mar.*), Kattali-Papas, Mullugalli (*Can.*).

History, Uses, &c.—This plant is a native of Mexico and Central America, and was introduced into India by the Portuguese, doubtless with the object of feeding the Cochineal insect upon it, but it is uncertain whether they ever carried out their intention. It is called by the Portuguese *Palmatoria d' inferno*, from the resemblance of its flat branches to a *palmatoria*, or flat piece of wood used in their schools to beat children upon the hand. The Hindus have given it the Sanskrit names of Vidara, "tearing asunder," and Vishva-sáraka, "having all essence."

In 1793—97, Drs. Anderson and Barry attempted to introduce the Cochineal insect, but they appear to have been supplied with the Cochinilla sylvestre, or wild Cochineal, which is said to be small and deficient in colouring matter; this insect is still found in India upon *O. Dillenii.* Dr Fontana, in a communication to the *As. Ann. Regist.* in 1799, states that the Cochineal insect thrived best on the *O. Dillenii*, but the insects from Bengal were found to contain only 10 to 16 per cent. of colouring matter, and fetched only Rs 5 per seer, whereas Mexican cochineal at the time was worth Rs. 16 to 20. The cultivation was subsequently abandoned, probably on account of the more profitable cultivation of Indigo.

Dr. Buchanan in 1801 found cochineal being reared in Mysore. The young insects were put upon the cactus hedges immediately after the rainy season. In six months they had increased sufficiently to begin to collect them; a year more elapsed before the whole plants were consumed. After pay-ing all expenses, the farmer sold the cochineal for 11 pence a pound. Dr. Buchanan calls the plants Nopals, their Mexican name, but states that it is the cactus "aboriginal of the country"; he also reports that the insect is of the bad kind recently introduced.

Roxburgh, speaking of *Cactus indicus* (*O. Dillenii*), says:—"Upon this plant the Cochineal insects lately brought from America thrive and multiply abundantly." In 1833-45, the culture of cochineal was again attempted by *M.* Sundt and others upon *O. Tuna* with the true Cochineal insect, and this culture appears to have been carried on to a certain extent, as in 1857 silver grain Cochineal from Chittledroog and Oosoor grown upon this plant was shown at the Madras Exhibition.

In 1848, Dr. Dempster successfully dyed woollen cloths with dye extracted from the insect found on the common prickly pear. The quantity of lake obtained by him from the native Cochineal exceeded that obtained from an equal amount of imported Cochineal, and was also of a more brilliant hue. Dr. Dempster laid particular stress on the advantage of cultivating the native insect in preference to importing foreign varieties, and his views were corroborated by Dr. McClelland of the Calcutta Botanic Gardens, who wrote on the subject in 1848. In the same year, Dr. Fleming found numerous villagers near Amritsar engaged in gathering Cochineal insects from the hedges of cactus or prickly pear. The Cochineal was dried and sold to the Amritsar dyers at one rupee a seer. It appears, however, that the growth of wild Cochineal is very irregular, the insects completely destroy the cactus plants wherever they appear, and some time must elapse before the plants can grow again. The quantity of native Cochineal produced in India is not known. Dr. Bidie, reporting on the culture of Cochineal in India in 1882, remarks:—"The efforts made about the beginning of the present century to establish the industry failed, owing to the introduction of an inferior variety of the Cochineal insect. One of the species of cactus on which the insect feeds in Brazil having been introduced with it in 1795 by Capt. Neilson, H. M. 7th Regiment, it has been naturalised, and

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there are various other species here on which the insect will feed." The report concludes with a description of a Mexican Nopalry or cactus garden, which could be easily imitated in many parts of India.

The Indo-Portuguese of the present day, as well as the natives of India, highly esteem the fruits of *O. Dillenii* as a remedy in whooping cough and asthma. From a few experiments we have made with a syrup of the fruit, which is of a splendid purple colour, it appears to increase the secretion of bile when given in teaspoonful doses 3 to 4 times a day, and to control the spasmodic cough and expectoration. In one case of asthma, due to the irritation of pregnancy, after every remedy which could be suggested had failed, it put a stop to the paroxysms which before its administration occurred regularly after sunset; but if the remedy was omitted they at once returned. Eventually a cure was effected. In several cases of whooping cough, a similar effect was produced as long as the syrup was taken daily, and in a case of bronchial catarrh in the chronic stage with copious expectoration, it almost entirely stopped the cough and expectoration within 24 hours. Its action is probably due to the soluble malate of manganese which we have found contained in the fruit. Kobert has shown that the salts of this metal when injected into the blood or subcutaneously, paralyse voluntary movement and reflex action, and stop the heart in diastole; the paralysis of reflex action being due to the destruction of the transverse conduction of the spinal cord, longitudinal conduction remaining intact.

Chemical composition.—The air-dried fruit heated to 100° C. lost 26·21 per cent. in weight. The ash amounted to 9·65 per cent., and was of a very light dirty reddish colour. Chemically the ash was of interest on account of the extremely large amount of manganese present. Boiling water extracted 46·95 per cent. of yellowish extractive, which contained 4·00 per cent. of ash. The solution had an acid reaction, and readily reduced an alkaline cupric solution on boiling. The acidity was due to malic acid, a trace of citric acid was also present.

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The total free acidity of the air-dried fruit calculated as malic acid amounted to ·63 per cent. The saccharine matter calculated as grape sugar amounted to 29·76 per cent. of the air-dried fruit.

An alcoholic extract of the fruit contained a fluid fatty acid in small amount, also some wax, resinous matter, malic acid, colouring matter, sugar, &c., &c. No alkaloidal principle could be detected.

FICOIDEÆ.

TRIANTHEMA MONOGYNA, *Linn.*

Fig.—*Dc. Pl. Grass.* 109; *Wight Ic., t.* 228.

Hab.—Throughout India. The root.

Vernacular.—Násarjanghi, Bishkhapra (*Hind.*), Vishkhápra (*Mar.*), Satudo (*Guz.*), Sharunnay (*Tam.*), Ghalijeroo (*Tel.*), Sabuni (*Beng.*).

History, Uses, &c.—This plant has been given the Sanskrit name of Sveta Punarnava, or white Bœrhaavia, from the resemblance of its foliage when young to that of *Boerhaavia diffusa*. Both plants when in this condition are eaten as vegetables after being well boiled. In common with *T. pentandra* and *T. decandra* its root is known to the natives of India as having cathartic and irritant properties, and is said to be sometimes given to women to procure abortion. Ainslie says: "The root, which is bitter and nauseous, is given in powder in combination with ginger as a cathartic; when fresh it is somewhat sweet." (*Mat. Ind.* ii., 370.) He also notices similar properties in *T. decandra*, and Stewart records that *T. pentandra* is said to be used in the Punjab to procure abortion. In native practise these roots are considered useful in obstructions of the liver, asthma and amenorrhœa. The dose as a purgative is about two drachms of the powdered root to be repeated until the desired effect is produced.

Description.—A diffuse, prostrate, branched, glabrous, fleshy plant, which appears at the commencement of the rainy

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season; leaves $\frac{1}{2}$ to $1\frac{1}{2}$ in., obovate; petiole $\frac{1}{4}$ in.; flowers solitary; calyx-lobes obtuse, cuspidate; stamens 10 to 20; capsule $\frac{1}{5}$ in., scarious below, beak exserted, coriaceous, somewhat mitriform, adnate to the enclosed seed, lower part 3 to 5-seeded. Seeds black, scarcely shining, with concentric, broken, and undulating, raised lines. (*Fl. Br. Ind.*)

Chemical composition.—The plant affords a thick mucilaginous decoction unaffected by iodine solution, and precipitated by ferric chloride and neutral acetate of lead. It gives a precipitate with barium hydrate, which contains a glucoside having similar properties to saponin; the insoluble decomposition product when weighed pointed to the presence of a small amount of this body.

MOLLUGO STRICTA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 26.

Hab.—Throughout India. The plant.

MOLLUGO SPERGULA, *Linn.*

Fig.—*Rheede Hort. Mal. x., t.* 24.

Hab.—Throughout India, except the N.-Western districts.

Vernacular,—Jima (*Hind., Beng.*), Toora-elley, Kacchantharai (*Tam.*), Chayntáráshiákoo (*Tel.*), Jharasi (*Mar.*), Kaipajira (*Mal.*), Parpataka (*Can.*).

History, Uses, &c.—These plants are called in Sanskrit Grishma-sundaraka and Phani-ja, and are in general use as a pot herb. The Hindi name is derived from the Sanskrit जिम or जम, to eat. Medicinally they are considered to be stomachic, aperient and antiseptic.

Rheede, speaking of *M. stricta*, says:—"Apozema ex tota hac planta confectum choleræ medetur; præparatur et ex illa balneum contra variolas. Succus vino permixtus, tridui spatio bis de die assumptus, variolas expellit, febrem concomitantem minuit." Ainslie (ii., 431,) writes to the same effect concerning *M. Spergula*, and adds that the plant is administered for suppression of the lochia, and when applied warm and moistened with a little castor oil, is reckoned a good application for earache. He considers that it is justly held in estimation by the native practitioners. In Pudukota the juice of *M. Spergula* is applied to itch and other skin diseases, and that of *M. hirta* (Sirooseroopadi, *Tam.*,) is administered internally to weak children. The latter plant is stated by Watt to be prescribed in the Punjab and Sind for diarrhœa under the names of Poprang, Gandi-buti and Kottruk.

Description.—*M. stricta:* Glabrous, stems much branched, leafy, often a foot high in rich wet soil, sometimes only a few inches where the situation is unfavourable Leaves ¾ to 1½ in., whorled or opposite, from lanceolate acute to obovate obtuse, much narrowed at the base; petiole hence obscure. Cymes compound, the branches sometimes racemed. Sepals 1/16 in., elliptic or round. Stamens 3 to 5, filaments dilated. Styles 3, short, linear. Capsule as long as the sepals, globose, many-seeded, the walls thin. Seeds dark chestnut-coloured; embryo curled into three quarters of a complete circle. (*Fl. Br. Ind.*)

M. Spergula: Glabrous or nearly so, branching, diffuse, leafy. Leaves ½ to 1 in., usually whorled, spathulate lanceolate or elliptic; petiole 0 to ⅛ in. Pedicels ⅛ to ½ in. Sepals ⅛ to ½ in., oblong, margins often membranaceous. Stamens 5 to 10. Stigmas 3, minute. Capsule ellipsoid, a little shorter than the sepals. Seeds many, covered with raised tubercular points, and appendaged by a minute short subulate bristle, and sometimes by a second, yet more minute bristle. (*Fl. Br. Ind.*)

Chemical composition.—The bitter principle of *M. stricta* is soluble in ether, alcohol and water, and is precipitated from the aqueous solution by tannin, but not by neutral lead acetate. It solution does not respond to alkaloidal tests, and it is decomposed by boiling with dilute hydrochloric acid. Evaporated portions dissolve in strong sulphuric acid with a brown colour. A bitter resin is also dissolved out of the herb by rectified spirit, and the chief constituent of the watery extract

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is a gum gelatinizing with ferric chloride. The dried herb deflagrated occasionally during the process of combustion in the open air; this was found to be due to the presence of alkaline nitrates. The white ash amounted to 68·1 per cent.

GISEKIA PHARNACEOIDES, *Linn.*

Fig.—*Wight Ic., tt.* 1167, 1168.

Hab.—The Punjab, Sind, South Deccan Peninsula, Ceylon. The plant.

Vernacular.—Bálu-ka-ság (*Hind.*), Walu-chi-bháji (*Mar.*), Manal-kirai (*Tam.*), Isaka-dasarikura (*Tel.*), Attirilla-pála (*Cing.*), Báluka (*Beng.*).

History, Uses, &c.—This plant is called in Sanskrit Bálu, Báluka, Váluka and Elaváluka on account of the number of large raphides contained in the leaves, and which give them the appearance of being full of sand (válu). Báluka is considered by the Hindus to be aromatic, aperient and anthelmintic, and is used as a vegetable like the Mollugos; the Hindi and Marathi names signify "sandy potherb." Capt. W. H. Lowther (*Journ. of Agri.-Hort. Soc. of India*, 1857, vol. ix., p. 285,) appears to have been the first to bring the anthelmintic properties of this plant to the notice of Europeans. The fresh plant, including the leaves, stalks, and capsules, is directed to be employed in cases of tænia, in doses of about an ounce, ground up in a mortar with sufficient water to make a draught. This is to be repeated three times at an interval of four days, the patient each time taking it after fasting for some hours.

Description.—A diffuse branched herb, Leaves opposite or falsely whorled, fleshy, $\frac{3}{4}$ to $1\frac{1}{4}$ in., oblong or elliptic, entire, narrowed at the base; petiole 0 to $\frac{1}{4}$ in. Sepals $\frac{1}{16}$ in. Filaments dilated below. Carpels usually 5, in fruit as long as the sepals. Seeds blackish, smooth, minutely glandular-punctate; embryo curved less than a semicircle. (*Fl. Br. Ind.*)

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Chemical composition.—The most interesting principles present in the seeds are astringent principles which we provisionally call α and β *Gisekia tannin.* α Gisekia tannin is obtained by agitating an alcoholic extract of the seeds with ether, it forms an orange varnish, in which nodules gradually form on standing, which on microscopic examination are seen to consist of narrow plates and a few needles of a deep yellow colour. The ether extract is easily soluble in alkalies with deep orange coloration, and is reprecipitated by acids in yellow flocks. In water the ether extract is nearly wholly soluble with yellow colour and astringent taste. Ferric and ferrous salts give a dirty deep brown coloration, without any tinge of blue. Potassium cyanide a deep orange coloration. Both acetates of lead gave a dirty yellow precipitate; cupric sulphate no precipitate. Lime water in excess a dirty reddish precipitate; Barium chloride and ammonia a similar precipitate. Potassium bichromate deep yellow, slowly changing to yellowish brown. Bromine water dirty brownish yellow. It reduces an alkaline copper solution on boiling and precipitates gelatine in white flocks.

β Gisekia tannin occurs as a deep orange powder, and is obtained by acidulating the aqueous alcoholic extract after agitation with ether, when the tannin is precipitated. In cold water it is slightly soluble, but dissolves easily in boiling water with a yellow coloration, the liquid becoming turbid on cooling. It is easily soluble in amylic alcohol Ferric salts afford a nearly black precipitate, without any tinge of blue. In alkalies it dissolves with a wine red coloration, the tint being brighter with ammonia than with the fixed alkalies. Potassic cyanide gives a similar coloration. Both acetates of lead afford flesh coloured precipitates. Bromine water a yellowish precipitate, sulphate of copper whitish. It precipitates gelatine in white flocks, and reduces slightly an alkaline copper solution on boiling.

We failed to detect any alkaloidal principle in the seeds. The authelmintic properties of the seeds are very probably due to these tannin-like principles.

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Commerce.—The seeds under the name of Baluka are sold by druggists in Bengal.

UMBELLIFERÆ.

HYDROCOTYLE ASIATICA, *Linn*

Fig.—*Hort. Mal. x.*, 46; *Wight Ic.*, t. 565; *Bentl. and Trim.*, *t.* 117. Indian Pennywort (*Eng.*), Bevilacque (*Maurice*).

Hab.— India. The plant.

Vernacular.—Brahmamanduki, Khulakhudi, Brahmi (*Hind.*), Thalkuri (*Beng.*), Karivana, Karinga (*Mar.*), Vallárai (*Tam.*), Khar-brahmi, Khi-brahmi (*Guz.*), Babassa (*Tel.*), Ondelaga (*Can.*).

History, Uses, &c.—In Sanskrit works this plant is called Brahmi and Mandukaparni Chakradatta directs the fresh juice to be given with milk and liquorice. In the Nighantas it bears many synonyms, and is described as cold, moist, sweet, light and alterative; it is said to improve the memory and understanding, and to cure leprosy, jaundice, gonorrhœa and fever. The plant was known to Rheede by its Malayalim name of Codogam or Kutakan, and also to Rumphius. Ainslie informs us that an infusion of the toasted leaves in conjunction with fenugreek is given to children suffering from bowel complaints and fever in doses of half a teacupful, also that the leaves on the Coromandel Coast are applied to parts that have suffered from blows and bruises, having, it is supposed, the power of keeping off inflammation. In Java, according to Horsfield, they are considered diuretic, and on the Malabar Coast the plant is one of the remedies for leprosy. As a remedy in this disease it was first brought prominently to notice by Boileau, in 1859. Dr. A. Hunter, who tried it in the Madras Leper Hospital, came to the conclusion that it had no claim to consideration as a specific in leprosy, but he found it most useful in ameliorating the symptoms and improving the

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general health. In the *Pharmacopœia of India* it has been made official, and is described as an alterative, tonic and local stimulant, more especially useful in syphilitic skin diseases, in which it may be used both as an internal and local remedy. Directions for making a powder and poultice are given. More recent reports from Europe (1885) confirm this statement, and there has been some enquiry for the drug in Bombay which has led to its cultivation on a small scale. In the neighbourhood of Bombay the plant is rare in a wild state, but may often be seen in gardens; it is a popular remedy for the slight dysenteric derangements of the bowels to which children are subject; 3 to 4 leaves are given with cumin and sugar, and the pounded leaves are applied to the navel. In the Concan one or two leaves are given every morning to cure stuttering; and the juice is applied to skin eruptions supposed to arise from heat of blood.* Dr. Clement Daruty de Grandpré (*Nouveaux Remédes, 8th April,* 1888,) states that this plant is so abundant in Mauritius that it serves as forage for cattle, whose milk it improves; it is also greedily eaten by pigs and other domestic animals. He says it should be very carefully dried and bottled to preserve the volatile oil which is the active principle, the whole plant should be used, including roots and fruit, as he finds it more active than the leaves only. Dr. Daruty observes that the administration of this drug to lepers causes at first a sensation of warmth and pricking in the skin, especially of the hands and feet; this is followed after a few days by a general sensation of warmth, sometimes almost unbearable; the capillary circulation is accelerated, and after about a week the appetite improves, and in time the skin becomes softer, throws off the thickened epidermis, and recovers its transpiratory function. Hydrocotyle augments the excretions from the bowels and kidneys. The dose is 10 grs. of the powder three times a day; in short, this drug is in small doses a powerful stimulant, especially of the cutaneous system, with the results above described in the case of lepers. In large doses it acts as a stupefying narcotic, producing headache, giddiness, and with some people a tendency to coma.

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* Generally as a *lép* with Cadamba bark, Ghi, and Black Cumin.

Description.—The plant grows freely all the year round if watered, sending out long runners, which produce leaves, roots and fruit at the joints. The peduncles and petioles are fascicled; the latter are frequently three to four inches long; the peduncles are very short, and bear a 3 or 4-flowered simple umbel with very short rays; the leaves are reniform, crenate, ½ to 2 inches in diameter, 7-nerved, glabrous, or when young somewhat hairy on the under side; the fruit is laterally compressed, orbicular, acute on the back; the mericarps reticulated, sometimes a little hairy, with 3 to 5 curved ribs; they have no vittæ. The fresh herb has an aromatic somewhat ivy-like odour when crushed and a nauseous bitter taste, but these qualities are to a great extent lost in drying.

Chemical composition.—Hydrocotyle has been analysed by Lépine of Pondicherry (*Journ. de Pharm. et de Chim.* [3] xxviii., p. 46), who found in it a peculiar body which he named *Vellarin*, and described as being obtainable from the dry plant to the extent of 0·8 to 1·0 per cent. He describes it as an oily non-volatile liquid, with the odour and taste of the fresh herb, soluble in spirit, ether, caustic ammonia, and partially in hydrochloric acid, and volatilizing at 120°. The authors of the *Pharmacographia* remark that these singular properties do not enable us to rank vellarin in any well characterised class of organic compounds; moreover, they failed to obtain anything like it from the dry herb.

We find that the fresh leaves contain about 78 per cent. of water.

Distilled with water some traces of a stearopten-like body were condensed and the distillate was neutral. The ether extract contained a white crystalline substance possessing the odour of the drug, with resin and fat amounting to 8·9 per cent. of the dried leaves. Alcohol dissolved 24·5 per cent. of tannin and sugar, the tannin gives a bulky green precipitate with ferric chloride and neutral acetate of lead, dissolves in alka-

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line solutions, and is reprecipitated by acids. 11·5 per cent. of gum, sugar, and salts was extracted by water, and 12·5 per cent. of albuminous matter by diluted caustic soda. The powdered leaves yielded 12·4 per cent. of ash, nearly half of which consists of alkaline sulphates. Lépine's vellarin was most probably a mixed substance composed of the odorous fatty body with some resin.

Commerce.—The dried herb is kept by the duggists. Value, Rs. 7 to 8 per Surat maund of 37½ lbs. It is generally much mixed with grass and weeds.

CONIUM MACULATUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 118. Hemlock (*Eng.*), Cigue (*Fr.*).

Hab.—Europe, Northern Asia. The fruit and root.

Vernacular.—Kirdamána, Kurdumána,* Khorasani-ajwán (*Ind. Bazars*).

History, Uses, &c.—We have met with no mention of Hemlock in Hindu works on Materia Medica. It is now generally admitted to have been the κώνειον of Greek writers, the celebrated *Athenian state poison*, by which Socrates died, and the Cicuta of the Romans.† Moreover, κώνειον is the modern Greek name for Hemlock. Ibn Sina identifies the شوکران (hemlock) of the Arabs and Persians with the κώνειον of Dioscorides. Ibn Baitár and Háji Zein-el-attár (A.D. 1368) also identify Showkrán with the κώνειον of the Greeks and Cicuta of the Romans; the former tells us that it is called Hafúz in Spain, and the latter writer says that it is known as *Dúras* in the district of Yezd, and that the best is obtained from the hills

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* Kurdumána according to the Burhán, where it is described as wild caraway, mountain caraway, Syrian caraway and Turkish caraway. The author of the Makhzan describes Kurdamána as an aromatic seed, and does not identify it with Conium.

† See Theophrastes H. P., i., 8; vi, 2; ix., 8. Dioscorides iv., 77; vi., 11. Pliny 25, 95. Plato, Lys. 219 E; Xenophon Hell. 2, 3, 56. Hippocrates 681, 4.

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of Taft and is called *Duras-i-Tafti,* and its root *Bikh-i-Tafti;* he describes the symptoms of poisoning by hemlock very correctly, and its termination by convulsions and failure of the respiration. The Indian bazar names, which signify "Syrian or wild caraway" and "Khorasán Ajowan" are apparently euphemistic.

The ancients were well acquainted with the properties of hemlock, and it is said that the priests of Eleusis, who were under a vow of chastity, used to rub their bodies with its juice. The Arabian and Persian physicians repeat almost word for word the opinions held by the Greeks concerning the medicinal properties of the plant; these opinions it is unnecessary to recapitulate, as they were those held by modern European physicians up to a comparatively recent date. The preparation of the plant recommmended for medicinal use by the Arabians is an extract made by expressing the juice of the unripe fruit and drying it; this preparation is doubtless far more efficient than the extract and tincture of our Pharmacopœias. Harley (*The Old Vegetable Neurotics,* 1869,) has shown that the green unripe fruits are the most active part of the plant, and that they may be even dried without loss of activity. From modern pharmacological research we learn that coniine paralyses the ends of the motor nerves and of the vagus, like curare, and afterwards paralyses the motor centres in the brain and spinal cord. It causes death by paralysing the respiratory muscles. Death is usually accompanied by convulsions in warm, but not in cold-blooded animals. There is dilatation of the pupil and ptosis from paralysis of the endings of the third nerve. Locally applied, it appears to paralyse the ends of the sensory nerves. Methyl-coniine acts on the spinal cord, causing paralysis of reflex action. Dimethyl-coniine and conhydrine have an action similar to that of coniine, but less powerful. (*Lauder Brunton.*)

In Europe hemlock is now chiefly used as a neurotic, the expressed and preserved juice of the unripe fruit being preferred to the old preparations, which contain hardly any of the active principles. It has been tried in tetanus and strychnia

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poisoning, but without success. In the East it is prescribed as a neurotic in painful affections of the skin and subjacent tissues, and as an antaphrodisiac. Mir Muhammad Mumin has a curious preparation in the Tuhfat, which he has named "*Umru's raisins*," and which he recommends as a preservative of the seminal fluid. It is made by stewing together 5 dirhams each of hemlock root and hyoscyamus seeds with 150 large raisins and 150 miskals of water until dry; the raisins are then removed and preserved. The dose is from one to three daily.

Description.—Kirdamana resembles English hemlock fruit, but is a little larger and of a darker grey colour; it appears to have been collected when mature or nearly so. If a section of the fruit is examined under the microscope it will be seen that there are no vittæ, and that the cells of the endocarp contain a brown substance, which consists of coniine and the other alkaloids together with a small quantity of volatile oil. Surrounding the albumen is a peculiar layer of small cubic cells. When crushed in a mortar with a few drops of *liquor potassæ*, kirdamana seeds have a mousey odour.

Chemical composition—The most important constituent of hemlock fruit is the volatile alkaloid coniine ($C^{8}H^{17}N$), a colorless, inflammable, oily fluid, specific gravity ·846 at 12°·5 C. Coniine has a strong alkaline reaction, a penetrating suffocating odour, and boils when pure at 168° to 169° C. It is soluble in all proportions in alcohol, ether, chloroform, benzol, benzine, and fixed oils, is less freely soluble in carbon bisulphide, and requires 100 parts of cold water for solution. Like ammonia, it forms dense white fumes with volatile acids, it precipitates most metallic salts, some of the precipitates, like silver, being soluble in an excess. It neutralizes acids, forming salts which are freely soluble in water and alcohol, are usually deliquescent, and occasionally uncrystallizable, and are not precipitated by platinic chloride. Its hydrochlorate and hydrobromate are, according to A. W. Hofmann (1881), easily obtained by dissolving coniine in anhydrous ether and passing into the solution dry hydrochloric or hydrobromic acid gas. The salts, being

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insoluble in ether, are precipitated in a white crystalline form; both are very soluble in water and alcohol, are not deliquescent and may be dried at 100° C. without decomposition.

Coniine is accompanied by *Conhydrine* ($C^8H^{17}NO$) and often by Methyl-coniine ($C^9H^{17}N$). the former of which is left in the retort on the careful distillation of crude coniine. Hemlock fruit contains also a fixed oil, a minute portion of non-poisonous volatile oil having the odour of cumin, and probably malic acid in combination with the alkaloids. The fully grown green fruit yields about 0·8 per cent. of coniine, *conhydrine* is always present in a very small proportion. According to Wernecke the fruit yields 6·69 per cent. of ash.

Coniine has been made synthetically by Ladenburg and its nature and derivation clearly shown. It is the dextro-rotatory *α* normal propyl-piperidine. In obtaining it, pyridine is first converted into *α* allyl-pyridine, which reduced by sodium in alcoholic solution yields an optically inactive *α* normal propyl-piperidine. The tartrate of this base is made and crystallized, when, following the analogy of the splitting of racemic acid into dextro-rotatory and lævo-rotatory tartaric acid, we get a dextro and a lævo coniine, of which the first is the true alkaloid of hemlock.

Toxicology.—No cases of hemlock poisoning appear to have been recorded in India. For white mice the lethal dose is ·0758 grm. per kilo body weight; whilst ·075 grm. does not cause death. (*Ladenburg.*)

Commerce.—The Persian seed is sold for Re. ½ per lb.

CUMINUM CYMINUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 134. Cumin (*Eng., Fr.*).

Hab.—Africa. Cultivated in India. The fruit.

Vernacular.—Jira, Safed-jira (*Hind., Beng.*), Shiragam (*Tam.*), Jilakara, Jiraka, Jirana (*Tel.*), Jirakam (*Mal.*), Jirige (*Can.*), Jiré (*Mar.*), Sufed-Jirun (*Guz.*).

History, Uses, &c.—The use of cumin as a spice and medicine is of the highest antiquity, and appears to have spread from the cradle of civilization in Egypt to Arabia, Persia, India and China. Cumin is mentioned in the Hebrew Bible, it is the κύμινον of the Greeks, and Theophrastus (H. P. IX.) tells us that it was the custom to utter curses when sowing it (probably to avert the evil eye). Dioscorides (iii., 61,) calls it κύμινον ἥμερον, and notices its medicinal properties; in the same chapter he mentions another kind of cumin, "the king's cumin of Hippocrates," which the Arabians identify with *ajowan*, and in the next chapter two kinds of wild cumin. Popular allusions to cumin are common in the writings of the Greeks and Romans, cumin and salt was a symbol of friendship (*Plut. Symp.* 5, 10, 1). Pliny tells us that students eat it to make themselves look pale and interesting. Greek writers mention a κύμινο-δοκον or cumin-box which was placed on the table like a salt-cellar. Flückiger and Hanbury trace its use during the Middle Ages, when it appears to have been much valued in Europe. Mannhardt (*Baumkultus der Germanen*) says that bread was spiced with cumin to protect it from the demons, and De Gubernatis (*Myth. des Plant.*) states that it is used for the same purpose in Italy, and on account of its supposed retentive powers is given to domestic animals to keep them from straying, and by girls to their sweethearts for the same reason.

Jira and Jirana, the Sanskrit names for cumin, as well as the Persian Zhireh or Zireh, and all the Indian vernacular names appear to be derived from the root Jri, and to allude to the digestive properties of the seeds; other Sanskrit names are Ajáji "that overcomes goats," ajamoda "goat's delight" and Kunchicka. The Arabic name Kamún is doubtless derived from the Greek. Ibn Sina and the Eastern Arabs, and also the Persians follow Dioscorides in describing four kinds of cumin, which they name Kirmáni or black, Farsi or yellow, Shámí (Syrian) and Nabti (Egyptian). They also mention along with them Karawya or caraway as a seed like anise. In the absence of accurate descriptions it is impossible to say what these four kinds were, but it seems probable that the Kirmáni or black cumin is correctly identified by the Indian Mahometans with the seeds known in India as Siyah-Jira, a species of caraway peculiar to Central Asia. The Nabti or Egyptian kind is probably true cumin.

Cumin is much used as a condiment in India, and is an essential ingredient in all the mixed spices and curry powders of the natives. Medicinally they regard it as stomachic, carminative and astringent, and prescribe it in chronic diarrhœa and dyspepsia. A medicinal oil is expressed from the seeds. Cumin is applied in the form of a plaster to allay pain and irritation. It is thought to be very cooling, and on this account it is an ingredient in most antaphrodisiac prescriptions, and is administered in gonorrhœa.

Description.—The fruit consists of two mericarps which remain united together when dry, and form an elongated ovoid body about $\frac{1}{4}$ inch long and $\frac{1}{16}$ broad in the middle, surmounted by the styles; each mericarp has five primary ridges and four secondary, the vittæ are six in number, two of them being situated on the commissural side; the seed is pentangular with rounded angles.

Chemical composition.—Cumin fruits yielded to Bley (1829) 7·7 per cent. of fat oil, 13·5 per cent. of resin, 8 of mucilage and gum, 15·5 of protein compounds, and a large amount of malates. Their peculiar, strong, aromatic smell and taste depend on the essential oil, of which they afford about 4 per cent. It contains about 56 per cent. of *Cuminol* (or *Cuminaldehyde*), $C^{10}H^{12}O$, a liquid of sp. gr. 0·972, boiling point 237° C. By boiling cuminol with potash in alcoholic solution, cuminalcohol, $C^{10}H^{14}O$, as well as the potassium salt of cuminic acid, $C^{10}H^{12}O^{2}$, are formed.

The oil of cumin, secondly, contains a mixture of hydrocarbons. That which constitutes about one-half of the crude oil was first obtained in 1841 by Gerhardt and Cahours and called *Cymene* or *Cymol.* It is a liquid of sp. gr. 0·860 at 15° C. boiling at 175° C. and has a lemon-like odour.

Cymene $C^{10}H^{14}$ may also be artificially obtained from a large number of essential oils having the composition $C^{10}H^{16}$, $C^{10}H^{14}O$, $C^{10}H^{16}O$, or $C^{10}H^{18}O$. It differs very remarkably from the oil of the formula $C^{10}H^{16}$, inasmuch as cymene yields crystallizable cymensulphonic acid, when it is warmed with concentrated sulphuric acid.

There is also present in oil of cumin a small amount of a terpene, $C^{10}H^{16}$, boiling at 155°·8 C.

Warnecke obtained 8·09 per cent. of ash from cumin fruit.

Commerce.—Cumin is grown in Northern India and is also imported from Persia and sometimes from Asia Minor. The exports, which range from 10 to 12 thousand cwts., are chiefly to Eastern ports, many of them Indian, Europe only taking from 500 to 600 cwts. The average value in India may be stated at from Rs. 6 to 8 per Surat maund of 37½ lbs.

CARUM COPTICUM, *Benth.*

Fig.—*Wight Ic.*, *t.* 566; *Jacq. Hort. Vind*, *tt.* 52, 200; *Bentl. and Trim.*, *t.* 120. Bishop's weed, Lovage (*Eng.*), Ammi de l'Inde (*Fr.*).

Hab.—Africa, cultivated in India. The fruit.

Vernacular.—Ajwain, Ajwán (*Hind*.), Joán, Ajowán (*Beng.*), Ova, Ajma (*Mar.*), Ajamo (*Guz.*), Omam (*Tam.*), Omamu, Yámamu (*Tel.*), Omu (*Can.*).

History, Uses, &c.—A small African seed called αμμι is described by Dioscorides (iii., 63); it had an odour like *origanon*, was of a very hot and dry nature, and was used as a carminative, &c. This seed was also called βασιλικὸν κύμινον or "king's cumin." A similar, if not identical drug is mentioned by early Sanskrit writers under the name of Yaváni or Yavánika, "of foreign origin," and appears to have been one of several seeds to which the name Ajmoda was also applied. In Persia also a similar seed was in use from a very early date as a seasoning for bread, under the names of zhinian (زنیان) and nánkháh (نانخواه), the latter name being a compound of *nán* 'bread'

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and *kháh* 'relish.' Ibn Sina notices it under the name of Nankhah, but does not identify it with any of the kinds of cumin which he mentions. Pliny (20, 58,) says that ammi and king's cumin are considered to be identical. Haji Zein-el-Attár (A. D. 1368) identifies *nankhah* with the ammi of Dioscorides and Paulus Ægineta, and quotes the opinions of those physicians concerning its medicinal properties. He also informs us that the drug has a reputation for its antiseptic properties, and is used to promote the healing of foul sores, and to remove the offensive odour of the discharges from them.

The author of the Tuhfat-el-muminin, and other Mahometan physicians, who have written in India, identify Ajowán with the *ammi* or *basilikon kuminon* of Dioscorides, and also with the *zhinian* and *nánkháh* of Persia; they give it the Arabic name of Kamún-el-mulúki, "king's cumin."

The authors of the *Pharmacographia* speaking of Fructus Ajowan, remark: "Owing to their having been confounded with some other very small umbelliferous fruits it is difficult to trace them precisely in many of the older writers on Materia Medica. It is however probable that they are the *Ammi* of Anguillaria (1561), and the *Ammi perpusillum* of Lobel (1571), in whose time the seeds were obtained from Egypt. They are certainly the *Ajave seeds* of Percival (1773), who obtained them from India." The plant is the *Ptychotis Ajowán* of later European writers on Indian Materia Medica.

In native practice, ajowán is much used as a carminative, either alone or in combination with rock salt, asafœtida, myrobalans, &c. It is also thought to check discharges of a chronic kind, and is therefore used in making lotions, collyria, &c.; upon the same principle it is prescribed in bronchitis with copious expectoration. A plaster or poultice of the crushed fruit is said to relieve pain. The *Ark* or distilled water of ajowan is prepared and sold in the bazars, and the stearopten under the name of *Ajowan ke phúl* (flowers of ajowan) is prepared at Oojein and elsewhere in Central India, by exposing the oil to spontaneous evaporation at a low temperature.

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Description.—The fruits are of the size and shape of those of parsley, of a greyish-brown colour, with a tubercular surface. Each mericarp has five prominent ridges, the intervening channels being dark brown, with a single vitta in each. The commissural side bears two vittæ. The odour resembles that of thyme.

Chemical composition.—The fruits according to Stenhouse (1855) yield 5 to 6 per cent. of an agreeably aromatic, volatile oil, sp. gr. 0·896. At the same time there collects on the surface of the distilled water, a crystalline substance. This stearopten, under the name of *Ajowan-ke-phul*, was first made known by Stocks, and was examined by Stenhouse and by Haines, who showed its identity with thymol, as contained in *Thymus vulgaris.* (*Pharmacographia.*) Thymol is the phenol of cymene, and its composition is shown by the formula C^6H^3, C^3H^7, CH^3, OH. Widman (1882) has succeeded in preparing it synthetically from cuminol by converting this into nitro-cuminol, acting upon this with phosphorus pentachloride, when nitro-cymylene chloride, $C^{10}H^{11}(NO^2)Cl^2$, is formed, and treating this with nascent hydrogen, first at a low temperatare, afterwards with the aid of heat, to obtain cymidin, $C^{10}H^{13}$, NH^2. A dilute solution of cymidin sulphate is treated with potassium nitrite, and finally distilled, when thymol is obtained, having the melting-point 44° C., which is the same as found by Lallemand and Stenhouse for thymol from the oils of thyme and of ajowan. (*Stillé and Maisch*) Thymol is most conveniently and completely extracted from oil of ajowan by shaking it repeatedly with caustic lye, and neutralizing the latter.

According to Wernecke ajowan seeds yield 10·45 per cent. of ash.

Cultivation and Commerce.—Ajowan is cultivated on the plains of India along with coriander, fenugreek and other crops which require similar treatment. The sowing season is October to November; the reaping time is February. The soil required is a deep rich loam thoroughly worked and manured with a small quantity of ashes from fuel prepared from cattle droppings. Strong manures are considered injurious to this crop. During the growing season of ajowan the climate is comparatively cool and very dry, rain falls at very irregular intervals, but at the sowing season, the soil will probably be saturated with moisture, and heavy dews prevail during the early half of the growing season. The temperature in theshade varies from 80° to 50° F.

Rain or irrigation to the extent of about ¼ inch weekly is required, therefore the soil is prepared for irrigation by making level beds about 8 feet square enclosed by ridges about six inches high. The ajowan is sown on the ridges by dibbling in the seeds about 6 inches apart, and coriander or fenugreek occupies the central bed. Assuming that the whole field was occupied by ajowan the quantity of seed required per acre would be 10 lbs., and the out-turn nearly 100 lbs. (*G. M. Woodrow.*) The average value of ajowan seed is about Rs. 2 per pharrah (35 lbs.). In 1881-82, Bombay exported 1,195 cwts. of the seed valued at Rs. 6,066.

The crude thymol manufactured in India has an average value of Rs. 8 per lb.

CARUM CARUI, *Linn.*

Fig.—*Bentl. and Trim., t.* 121. Caraway (*Eng.*), Carvi (*Fr.*).

Hab.—Cashmir, Gurhwal, Persia. The fruits.

Vernacular.—Indian caraways: Siyah-jira (*Hind.*), Guniyún (*Cashmere.*), Umbhú (*Ladak.*), Sa-jirè (*Mar.*), Shimai-shiragam, Pilappu-shiragam (*Tam.*), Sima-jilakara (*Tel.*), Shime-jirige (*Can.*), Shia-jira (*Beng.*), Kalun-jirun (*Guz.*).

European caraways: Vilayati-jira (*Hind., Mar., Guz.*), Kekku virai, Shimai-shombu (*Tam.*), Kekku-vittulu, Shima-sopu (*Tel.*) Shime-sopu (*Can.*), Bilati-jira (*Beng.*).

History, Uses, &c.—A kind of caraway called Sushava and Krishna-jiraka* or "black cumin" appears to have been

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* This name is also applied to the seeds of *Nigella sativa.*

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known to the Hindus before the introduction into India of European caraway seeds. Royle is the first European writer who notices *Zeera seeah* as a kind of caraway imported from Kunawar, and as they are of a much darker colour than ordinary caraways he named them *Carum nigrum* (*Him. Bot.* 229). Stewart reduces Royle's *C. nigrum* to *C. Carui*, and in this view he appears to be supported by Mr. C. B. Clarke in the *Flora of British India*. The same variety of caraway is known in Persia as Zireh-i-siyah, and as it is principally cultivated in the neighbourhood of Kirmán, is also called Zireh-i-Kirmáni.

The European caraway is first mentioned by the Arabians under the name of Carawiya. Ibn Sina, Edrisi and Ibn Baitar all treat of it as distinct from cumin. The καρον of the Greeks, so often identified with the caraway, appears to have been quite a different plant, as it afforded a root in common use as a vegetable which Paulus Ægineta classes with parsnips and carrots. The Mahometan physicians derive the name Karawiya or Kuruya from the Syrian Kârui, and give ἀρμένιον as the Greek for caraways, a word applied by Greek and Latin writers to several of the products of Armenia. They describe the seeds as aromatic, carminative and astringent; from them they prepare an eyewash, which is supposed to strengthen the sight; they are also used as a pectoral, and considered to be diuretic and anthelmintic. A caraway bath is recommended for painful swellings of the womb, and a poultice for painful and protruding piles.

Description.—The fruits are ovoid, slightly arched, laterally compressed, crowned by the style; they vary in size, but are generally about 1-6th of an inch long and 1-20th in diameter. The colour is brown, but the ribs are of a lighter colour than the furrows. The mericarps are generally separated; each on transverse section is seen to have five ridges, and to be of a pentagonal form with unequal sides; between the ridges are four vittæ, the commissural side being provided with two, which are placed close together. Within the pericarp is the seed, which is conform to the fruit. Caraways, like cumin, have a powerful odour. The black caraway approaches very nearly to cumin both in odour and flavour, the fruit is more slender and of a darker colour than the common caraway, but a transverse section shows a similar structure.

Chemical composition.—Trommsdorff besides volatile oil found in caraways a green fixed oil, a little wax, resin, sugar, mucilage, and some tannin. By repeated fractional distillation Völkel (1840) separated *carvene,* $C^{10}H^{16}$, which has little odour and taste, boils at 173° C., and has a strong dextrogyrate rotation. The higher boiling fraction contains *carvol,* $C^{10}H^{14}O$, which is liquid, has an agreeable caraway odour, boils at 227° C. (*Gladstone*) or at 250° C. (*Varrentrapp*), and has a levogyrate rotation. Carvol is isomeric with menthol, myristicol, thymol, and cumin alcohol. According to Warnecke the fruit yields 5·27 per cent. of ash.

Commerce.—European caraways are imported into India from England, and occasionally from the Levant, and are sold for about Re. 1 per lb. The black caraway is imported into Northern India from Afghanistan, Cashmere, and other parts of the Punjab Himalaya, also from Persia. The average value is Rs. 8 per Surat maund of 37½ lbs. if purchased in bulk, but as the bales contain much trash, the retail price of the clean seeds is not less than 8 annas per lb. In 1881-82 the imports into Bombay from Persia amounted to 2,683 cwts., valued at Rs. 71,886. The exports were 5 cwts. to Mauritius and 4 cwts. to Aden.

Carum Roxburghianum, *Benth. Wight Ic.* 567, Ajmod (*Hind.*), Rándhani (*Beng.*), Rándhani, Karonjha (*Mar.*) is an herbaceous plant resembling single parsley, and is supposed to be a cultivated form of *C. stictocarpum* common in the Concan, and bearing the same Marathi name as the cultivated plant. In many parts of India it is cultivated for its fruit, which is used in native cookery; elsewhere it occurs as a weed of cultivation, or is grown on a small scale to be used instead of parsley, for which it is a fair substitute, though objected to

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by some on account of its coriander-like flavour. It is worthy of remark that the Marathi name rán-dhani (wild coriander) is in use in Bengal. The fruit of this plant must not be confounded with the Bori-ajmod or Tukm-i-karafs of the shops, which is celery fruit imported from Persia. Rándhani is sometimes used as a carminative in dyspepsia, and is probably a fair substitute for caraways. The fruit is about $\frac{1}{12}$ of an inch in length, and is studded with blunt simple hairs; each mericarp has five ridges, which are paler than the spaces between them, and about 15 vittæ. The wild form (*C. stictocarpum*) is a much more slender plant, and has fruit about half the size of the cultivated variety.

APIUM GRAVEOLENS, *Linn.*

Fig.—*Eng. Bot. xvii., t.* 1210. Celery (*Eng.*), Céleri (*Fr.*).

Hab.—N.-W. Himalaya, Persia. The fruit.

Vernacular.—Karafs (*Arab., Ind. Bazars*), Ajmod (*Hind.*), Bodiajamo (*Guz.*).

History, Uses, &c.—Celery does not appear to have been known to the ancient Hindus. The Arabians probably obtained their knowledge of it from the Greeks. Dioscorides describes five kinds of σελίνον. Sprengel refers two of these to *Apium graveolens, viz.,* σελίνον κηπαῖον and ἐλειοσέλινον, var. *sativum et sylvestre.** The Selinon of Theophrastus (*H. P.* i., 15, 16, 19; iv. 9, viii. 5) was probably Celery; he also mentions Eleioselinon (vii., 6). Hipposelinon (ix., 1.), a diuretic, the root yielding a gum like scammony and Oreoselinon (vii., 6). Muhammad Husain, who wrote in India about one hundred and twenty years ago, informs us that Karafs is the celery of the Europeans and the Udasaliyun of the Greeks. He describes three other kinds, *viz.,* Sakhrí, in Greek Fiturasaliyun; Nabti, in Greek Akùsaliyun; and Tari, in Greek Shamaríniyun. What all of these may be, it is difficult to decide. Fiturasaliyun is now the bazar name in Bombay for the fruits of *Prangos pabularia*, but it is evidently a corruption of the Greek Petroselinon, and had once a different meaning, being described in Arabic works as like Ajowan.* The fruits imported into Bombay from Persia under the name of Karafs, and sold in the bazars as Borí-ajmúd, agree in structure with those of *A. graveolens*. Mahometan writers describe Karafs as deobstruent and resolvent, and use it in the form of a poultice with barley meal; they recommend it internally as a pectoral and as a tonic and carminative adjunct to purgatives, also as a diuretic, emmenagogue, lithontriptic, and alexipharmic.

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* Conf. Dios. iii., 67, 68, 69, 70, 71. Hipp. περί νουσεων ii. 19. περὶ διαιτης ii, 25. περὶ παθων 48. The Ancients made chaplets of celery, which were given to the victors at the Isthmian and Nemean games, and hung upon tombs. It is the Apium of Pliny; 19, 46.

In European medicine *apiol*, a camphor common to the fruits of this plant and of parsley, has been recommended as an emmenagogue and febrifuge, but more exact observation has proved its inutility. The physiological effects produced by this substance are headache and passing intoxication, and after repeated ingestion, digestive disturbances, loss of appetite, and even fever.

Description.—Karafs or Borí-ajmud imported into Bombay from Persia is a very small fruit, which, when the two mericarps are united, as is often the case, is almost globular; it is quite smooth and remarkable for the size and prominence of its ridges; the vittæ are 11 to 12 in number, two of these are on the commissural side. The taste is at first like anise, but afterwards bitter. The odour like anise, but faint.

Chemical composition.—Celery seeds, like those of parsley, contain *Apiin*, a substance first obtained by Rump in 1836 from the leaves, stalks, and seeds of common parsley; it was afterwards more exactly examined by Lindenborn, who obtained it by careful evaporation of the alcoholic solution in needles, which gave by analysis 54·71—55·25 per cent. carbon and 5·49—5·60 hydrogen, and further showed that it is a glucoside, splitting up, when boiled with dilute sulphuric acid, into glucose and *Apigenin* (66·13 per cent. C. 3·9 H.). From these numbers Lindenborn inferred that apigenen is isomeric with quinone, and assigned to apiin the formula $C^{12}H^{14}O^{7}$, representing its decomposition by the equation, $C^{12}H^{14}O^{7}+H^{2}O=C^{6}H^{4}O^{2}+C^{6}H^{12}O^{6}$. Quite recently apiin has been further examined by E. v. Gerichten (*Deut. Chem. Ges. Ber.* IX., 1121), whose results agree in the main with those of Lindenborn, his analysis of apiin giving 53·55 per cent. C., 5·36 H., and that of apigenin 65·12—66·21 C., and 3·75—3·91 H.

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* Adams considers πετροσέλινον to be the Stone Parsley, *Petroselinum macedonicum*, still cultivated in Europe.

Apiin is slightly soluble in cold, easily in hot water, still more easily in hot alcohol, insoluble in ether; from the aqueous or alcoholic solution, it always separates by slow cooling in the form of a jelly. It dissolves in alkalies with a light yellow colour. Its hot aqueous solution gives no precipitate with silver nitrate, lead nitrate, or copper sulphate, a brown-red precipitate with ferric chloride, a blood-red coloration with ferrous sulphate. Apiin is powerfully dextrogyrate, its specific rotatory power for yellow light being + 173°. (*Gmelin's Handb.* 16, 94; *Watts' Dict. of Chem.* VIII., Pt. I., 117.) The seeds and herb yield a colourless or pale yellow essential oil, sp. gr. 0·881. *Apiol* or Parsley camphor, which has lately been obtained from parsley seeds, is also found in those of Celery.

Commerce.—Value, Rs. 6 per Surat maund of 37½ lbs.

FŒNICULUM VULGARE, *Gärtn.*

Fig.—*Bentl. and Trim.*, *t.* 123. Fennel (*Eng.*), Fenouil (*Fr.*).

Hab.—Cultivated in India. The fruit and root.

Vernacular.—Bari saunf (*Hind.*), Panmohuri (*Beng.*), Wariárí (*Guz.*), Bari-shopha (*Mar.*), Shombu (*Tam.*), Sopu (*Tel.*), Somp (*Can.*).

History, Uses, &c.—Fennel is identified by Mahometan writers as the μάραθον of the Greeks, who also called it μάραθρον. It is mentioned by Hippocrates and Dioscorides as a diuretic and emmenagogue, and the juice was supposed to sharpen the eyesight. Nicander and Pliny mention certain superstitious

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notions concerning fennel, which are expressed in the following lines by Macer Floridus (*De Vir. Herb.*):—

> Cum vino cunctis obstat hæc herba venenis;
> Hac morsa, serpens oculos caligine purgat,
> Indeque compertum est humanis posse mederi
> Illam luminibus, atque experiendo probatum—
> Urinas purgat et menstrua sumpta resolvit,
> *Vel si trita super pecten hæc herba ligetur*—
> Tradunt auctores *ejus juvenescere gustu.*
> *Serpentes*, et ob hoc *senibus prodesse putatur*.

Indian Sweet Fennel is rather smaller and straighter than the European article. but in other respects is similar to it. Fennel fruit is used by the natives of India as a condiment and as an aromatic adjunct to medicines. A distilled water, known as Ark-i-bádián, is prepared from it. The Sanskrit name is Madhurika (sweet). As pointed out by Mr. M. Sheriff in his Appendix to the *Pharmacopœia of India*, this plant and the anise are often confounded in Arabic and Persian works on Materia Medica. The Persians call the fruits of both Razianah, but the Hindu dealers in Bombay call Fennel Wariarí and Anise Erva-dos. The root of fennel is rather an important medicine in native practice, being to the present day esteemed as one of the five opening roots of the ancients.*

Description.—The fruits are oblong, cylindrical, about 3-10ths of an inch long and 1-10th in diameter, nearly straight, terminating with the two-pointed base of the style and smooth on the surface. Each mericarp has five prominent ridges. Between the ridges are vittæ, and there are two on the commissural surface. The colour of the fruit is a pale greenish yellow, the odour like that of anise, and the taste sweet and aromatic.

Chemical composition.—Fennel fruit yields about 3 per cent. of volatile oil, which consists of *anethol* or anise camphor, $C^{10}H^{12}O$, and variable proportions of a liquid isomeric with oil of turpentine. Anethol is obtainable from fennel in two forms, the solid and the liquid; crystals of the former are deposited when the oil is subjected to a somewhat low temperature; the liquid anethol may be got by collecting the portion of the crude oil passing over at 225° C. The crystals of anethol fuse between 16 and 20° C., the liquid form of anethol remains fluid even at —10° C. By long keeping the crystals slowly become liquid, and lose their power of reassuming the crystalline form. (*Pharmacographia.*) Wernecke found 7·25 per cent. of ash in the fruit.

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* The five opening roots are Fennel, Parsley, Wild Celery, Asparagus and Butcher's Broom (*Ruscus aculeatus*). The wild bitter Fennel is probably the *μαραθρον* of Dioscorides (iii., 74) and of Theophrastus, H. P. i. 18, 19, vi. 1, 2; vii. 3).

Commerce.—Fennel is largely cultivated on the table lands of India. The fruit sells for Rs. 3 to 4 per Surat maund of 37½ lbs. The exports from Bombay in 1881-82 were 2,201 cwts., valued at Rs. 16,630; only 5 cwts. went to the United Kingdom, and the rest to Eastern ports.

PEUCEDANUM GRANDE, *C. B. Clarke.*

Hab.—Hills of Western India. The fruit.

Vernacular.—Dúkú (*Hind., Bomb.*), Báphali (*Mar.*).

History, Uses, &c.—The fruit of this plant has been adopted in India as a substitute for the Daucus seeds of the ancients, which were obtained from a species of Athamanta growing in Crete. This adoption was probably due to the early visits of Greek travellers and traders to Thana, and to the subsequent resort to the same port of the Mahometans early in the 14th century. The plant is common on the hills of the Concan, and was probably brought for sale to Thana in those days, as it still is at the present time. In Royles' Materia Medica, Falconer is quoted as describing Dúkú as a fruit resembling that of Asafetida, and as probably derived from some species of Ferula; this is just such a fruit. Dúkú was justly considered by the ancients as carminative, stimulant, and diuretic. Other umbelliferous fruits are not unfrequently substituted for this drug. We have received those of *Dorema Ammoniacum* from Bengal, and those of an Asafetida plant from Northern India. Haji Zein under the name of مرمج

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(marmaj) mentions an Indian seed having the appearance and properties of Daucus.

Description.—Plant three to seven feet high, having very much the appearance of a garden parsnip which has run to seed; root large, perennial, all quite smooth; leaves mostly radical, long-petioled, bipinnate; leaflets trilobate; lobes large, rounded; margins crenate serrate, shining on both sides; cauline leaves 1 to 2, biternate; stem round, smooth, striated, involucre and involucel leaves oblong or obovate, obtuse, partial rays numerous, many flowered; flowers yellow; fruit large, broadly elliptical, varying in size, the largest are ⅝ of an inch long and ⅜ broad; foliaceous, convex in the middle, with a dilated border, consisting of coarse cellular tissue; colour reddish yellow over the seed, margin pale yellow; dorsal ridges seven, the three central filiform; vittæ in dorsal furrows ten to thirteen; vittæ of commissure six. The fruit has a powerful lemon odour with a *soupçon* of carrot.

Chemical composition.—Twenty-five pounds of the fruit distilled with water yielded 6 fluid ounces of a light yellow essential oil having the odour of the fruit; it was dextrogyre, a column of 100 m. m. rotating 36 degrees. The specific gravity at 15°·5 C. was ·9008. Cooled to − 14° C. it was still liquid and no crystals separated. After dehydration the oil commenced to boil at 76° C., the temperature rapidly rose to 100° C., when a few drops distilled over; the temperature continued to rise rapidly to 185° C., up to this temperature 2 per cent. distilled over. The subsequent progress of the distillation may be tabulated as follows:—

2nd fraction	...... 185° to 190°	17	per cent.
3rd ,,	...... 191° to 196°	15	,,
4th ,,	...... 196° to 200°	12·5	,,
5th ,,	...... 200° to 205°	9·6	,,
6th ,,	...... 206° to 210°	6·4	,,
7th ,,	...... 210° to 220°	4·5	,,
8th ,,	...... 220° to 225°	4·0	,,
9th ,,	...... 226° to 228°	3·0	,,

The residue left in the flask boiled constantly at the last recorded temperature and amounted to 26 per cent. The fractions up to the 6th were colourless, those below of a yellow colour. The residue in the flask was viscid and of a deep yellow tint. Treated with reagents the oil in its original state afforded the following reactions:—Bromine dissolved in chloroform, at first nearly colourless, turning to dirty brown with a tinge of red, and finally to a dirty sage green. Concentrated sulphuric acid, deep orange to red. Frohde's reagent, yellow, deep brown, violet to deep blue, the changes in colour being extremely rapid. Nitric acid gave a yellow coloration. Picric acid dissolved in the oil. With solid iodine much heat was evolved. Gaseous hydrochloric acid was passed into the oil for some time, but on cooling the liquid no crystalline deposit separated. A slight precipitate of silver was produced from an ammoniacal solution of the nitrate.

Commerce.—The fruit is worth about Rs. 6 per pharrah (about 25 lbs.).

PEUCEDANUM GRAVEOLENS, *Benth.*

Fig.—*Bentl. and Trim., t.* 132. Dill, (*Eng.*), Aneth, Fenouil puant (*Fr.*)

Hab.—Cultivated in India. The fruit.

Vernacular.—Sowa (*Hind.*), (Shepu *Mar.*), Shoyikirai-virai, Shatakuppi-virai (*Tam.*), Shatakuppi-vittulu (*Tel.*), Sabbasagi (*Can.*), Shonva (*Beng.*), Suva (*Guz.*).

History, Uses, &c.—Dill seed is much esteemed by the natives of India, who use it as a condiment and medicine. An infusion of it is given as a cordial drink to women after confinement. The leaves moistened with oil are used as a stimulating poultice or suppurative, The Sanskrit names are Misreyá and Shatapushpa. Mahomotan writers describe Shibbit as resolvent and deobstruent, carminative, diuretic, and emmenagogue. The Persian name is Shúd and the Yunáni Anitun.*

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* Compare with Dioscorides *περὶ ανηθου* (iii., 60). Pliny (20, 74). Hippocrates *περί διαιτης* (ii., 25). Many Greek writers speak of Anethon and Anison as one and the same plant, but Alexis Λέβ. 2, 7, distinguishes them.

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Description.—The fruits of the Indian plant, which has by some been called *Anethum Sowa*, do not differ in any important respect from those of the European plant. The mericarps are somewhat narrower and more convex, the ridges more distinct, and the border less winged.

Chemical composition.—Dill fruits yield from 3 to 4 per cent. of an essential oil, a large proportion of which was found by Gladstone (1864-72) to be a hydrocarbon, $C^{10}H^{16}$, to which he gave the name *Anethene*. This substance has a lemon-like odour, sp. gr. 0·846, and boils at 172° C. It deviates a ray of polarized light strongly to the right. Nietzki (1874) ascertained that there is, moreover, present another hydrocarbon, $C^{10}H^{16}$, in a very small proportion, which boils at 155 to 160°. A third constituent of oil of Dill is in all probability identical with carvol. (*Pharmacographia*, 2nd Ed., p. 328.)

Commerce.—Suva is cultivated throughout tropical and sub-tropical India in the cold season. Value, Rs. 3⅝ per pharrah (about 35 lbs.).

CORIANDRUM SATIVUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 133. Coriander (*Eng.*), Coriandre (*Fr.*).

Hab.—Cultivated in India. The fruit.

Vernacular.—Dhanya (*Hind.*), Dhanya, Dhana (*Mar., Guz.*), Kotamalli (*Tam.*), Danyalu (*Tel.*), Kottumbari (*Can.*).

History, Uses, &c.—The Coriander plant is called Kothmir, a name derived from the Sanskrit Kusthumbari; when young it is much used in preparing chutneys and sauces. The fruits are largely used by natives as a condiment; as a medicine they are considered carminative, diuretic, tonic, and aphrodisiac, and are often prescribed in dyspepsia. A cooling drink is prepared from them pounded with fennel fruit, poppy seeds, Kanchan flowers, rosebuds, cardamoms, cubebs, almonds and a little black pepper; it is sweetened with sugar. Mahometan writers describe them as sedative, pectoral and carmi-

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native; they prepare an eyewash from them which is supposed to prevent small-pox from destroying the sight, and to be useful in chronic conjunctivitis. Coriander is also thought to lessen the intoxicating effects of spirituous preparations, and with Barley meal to form a useful poultice for indolent swellings. It is the Kuzbura of the Arabs and Kishníz of the Persians, who identify it with the Koriyun of the Greeks.* The opinion that it has great cooling properties prevailed amongst Western physicians, "coriandrum siccum frangit coitum, et erectionem virgæ impedit." Apuleius says it assists women in child-birth and protects them from fever. The following is an example of a cooling confection of the time of Charles the First:—R. Seminis Lactucæ, Portulacæ. Coriandri ana ana ʒi. Menth. siccæ ʒss, Sacchari alb. ℥iv. Pulverisentur omnia subtiliter, et post ea simul misce aqua nenupharis, f. confectis solida in morsulis, ex his sumat mane unum quum surgat.

Description.—Indian Coriander is much larger than that grown in Europe, and of an ovoid form; it consists of two mericarps firmly joined together, they are crowned by the stylopodium and calicinal teeth. Hanbury and Flückiger have the following excellent description of the fruit:—"The pericarp bears on each half four perfectly straight sharpish ridges, regarded as secondary (juga secundaria); two other ridges often of darker colour, belonging to the mericarps in common, the separation of which takes place in a rather sinuous line. The shallow depression between each pair of these straight ridges is occupied by a zigzag raised line (jugum primarium), of which there are therefore 5 in each mericarp. It will thus be seen that each mericarp has five (zigzag) so-called primary ridges, and four (keeled and more prominent) secondary, besides the lateral ridges, which mark the suture or line of separation. There are no vittæ on the outer surface of the pericarp. Of the five teeth of the calyx, two often grow into long pointed, persistent lobes; they proceed from the outer flowers of the umbel. Though the two mericarps are closely united, they adhere only by the thin pericarp, enclosing when ripe a lenticular cavity. On each side of this cavity, the skin of the fruit separates from that of the seed, displaying the two brown vittæ of each mericarp. In transverse section, the albumen appears crescent-shaped, the concave side being towards the cavity. The carpophore stands in the middle of the latter as a column, connected with the pericarp only at the top and bottom."

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* Confer. Dios. *περι κορίου*, iii., 64. Theophr. H. P. (*κόριαννον*), vii., 1, 3, 4, 5. Pliny, 20, 82.

Chemical composition.—The essential oil is isomeric with borneol, formula $C^{10}H^{18}O$. According to Kawalier, if the elements of water are extracted by phosphoric anhydride, it is converted into an oil of offensive odour, formula $C^{10}H^{16}$.

The fruits yield from 0·7 to 1·1 per cent. of volatile oil and 13 per cent. of fixed oil.

Flückiger obtained from the green herb from 0·57 to 1·1 per mille of an oil having an offensive odour, which deviated the ray of polarized light 1·1° to the right when examined in a column of 50 mm. long. The oil distilled by him from ripe fruit deviated 5·1° to the right.

Warnecke has found in Coriander fruit 5·21 per cent. of ash.

Commerce.— Coriander is cultivated throughout tropical and sub-tropical India; it is worth about Rs. 3 per pharrah (about 35 lbs.). It is largely exported to eastern ports.

PIMPINELLA ANISUM, *Linn.*

Fig.— *Bentl. and Trim., t.* 122. Anise (*Eng.*), Anis (*Fr.*).

Hab.—Persia, Europe, cultivated. The fruit.

Vernacular.—Erva-dos (*Bomb.*). The Indian names for Anise are the same as those for Dill.

History, Uses, &c.—Anise does not appear to have been known to the ancient Hindus, and is not mentioned in Sanskrit works. It was introduced into India by the Mahometans from Persia, whence the supply for the Bombay market still comes. Anise is now grown in Northern India.

The natives use anise in the same way as we do. The Persians call it Rázíánah, which the Arabs corrupt into Razianaj. They identify it with the Anisum of the Greeks,* and the Mahometan druggists of India know it by this name. The Bombay name, Ervados, is a corruption of the Portuguese 'Herba doce.' M. Sheriff states that the seeds of *Carum Roxburghianum* are sold in Southern India as Anisum.

Description.—The fruit varies a good deal in size; if well grown it should be about 2-10th of an inch long. The mericarps often adhere together with the pedicel attached, forming an ovoid body crowned by a pair of styles. Each fruit has 10 ridges, and is covered with short hairs. The taste is remarkably sweet and aromatic. The vittæ, which contain the essential oil, are very numerous, each mericarp being provided with about fifteen.

Chemical composition.—The fruit yields from 2 to 3 per cent. of essential oil, which is a colourless liquid, but after a time becomes yellow. It has the taste and odour of the fruit, sp. gr. 0·977 to 0·983. At from 10 to 15° C. it becomes a crystalline mass. Oil of anise resembles oil of fennel (*vide* Fennel) in that it consists almost entirely of anethol. Warnecke found 6·70 per cent. of ash in the fruit.

Commerce.—Anise is imported from Persia. Value, Rs. 5 to Rs. 6 per Surat maund of 37½ lbs.

ANTHRISCUS CEREFOLIUM, *Hoffm.*

Fig.—*Eng. Bot.*, 1268; *Jacq. Aust.*, 390. Chervil (*Eng.*) Cerfeuil (*Fr.*).

Hab.—Europe. Cultivated elsewhere.

Vernacular.—Atrilál (*Ind. Bazars*).

History, Uses, &c.—One of the oldest of cultivated potherbs. It is mentioned by Aristophanes, who wrote about

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* Comp. Dios, περὶ ἀνίσου, iii., 58, and Plin. 20, 72, 73.

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430 B.C., as a herb sold by the greengrocers. In his Acharnes (line 478) he has σκάνδικά μοι δὸς, μητρόθεν δεδεγμένος in allusion to the mother of Euripedes being a seller of Chervil. Theophrastus and Diocorides were well acquainted with it, and describe it as diuretic, stomachic and deobstruent. Pliny (22, 38,) speaks of Scandix and Anthriscum as nearly the same plants,—the latter appears to have been the cultivated chervil—he says:—"Its principal virtue is that it re-invigorates the body when exhausted by sexual excesses, and acts as a stimulant upon the enfeebled powers of old age." Ibn Sina calls it Rijl-el-ghuráb, and says that Paulus and others have recommended it in colic. Haji Zein-el-Attar (A.D. 1368) has the following account of Atrilál; "There are two kinds of seed, dark and light-coloured like celery seed in size, and cumin in shape, very bitter. The light coloured is the largest, and is the kind called Khilal-i-Khalil in Persian; this is true Atrilál, different from the Egyptian: it grows at Ahwaz. The Egyptian kind is also called Rijl-el-tair, Rijl-el-ghuráb, and Harj-es-shayatin "devil's bane". Atrilál is useful in white leprosy and tetter. One dirham alone, or with one dang of Pyrethrum, is rubbed down with honey and administered; the patient then sits in the sun until he sweats; this causes the formation of blisters and the discharge of yellow serum from the affected part, and the skin recovers its natural colour. The powdered seeds used as a snuff cause abortion." In the Madd-el-kámus, Lane has the following summary from Arabian authorities:—Rijl-el-ghuráb signifies a certain herb called, in the language of the Barbar, Itrilál, and in the present day Zir-el-ákileh, resembling the *Shibith* in its stem and in its *jummeh* (or node whence the flower grows) and in its lower part, or root, except that its flower is white, and it forms grains nearly like those of Makdúnis (parsley). A dirham of its seeds, bruised and mixed with honey, is a tried remedy for eradicating the برص (white leprosy) and the بهق (tetter) being drunk,—and sometimes is added to it a quarter of a dirham of pellitory,—the patient sitting in a hot sun, with the diseased part uncovered. In Boethor's Dict. Français-Arabe, the names Rijl-el-ghuráb and

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Atrilál are given to Chervil and Buckshorn plantain (*Plantago coronopus*).

Chervil has been cultivated in England since A.D. 1590, and has run wild in some parts of the country; it is much used on the continent of Europe as a pot-herb. *A. sylvestris*, or wild Chervil, is said to be poisonous; it has an acrid bitter taste.

Description.—Fruits lanceolate, laterally compressed, almost cylindrical, black, smooth, terminating in a short 5-angled beak, crowned with the depressed wavy receptacle of the flower. Taste aromatic, free from bitterness.

Commerce.—In the Indian bazars the fruit of *Vernonia anthelmintica* is generally supplied for Atrilál by Mahometan druggists; the genuine article is hardly ever obtainable.

DAUCUS CAROTA, *Linn.*

Fig.—*Wight Ill., t.* 117, *fig.* 7.

Hab.—Cashmere, Western Himalaya. Cultivated throughout India.

Vernacular.—Gájar (*Hind., Guz., Mar., Beng.*), Gájjara-kelangu, Manjal-mutlangi (*Tam.*), Gájjara-gádda, Pita-kanda (*Tel.*)

History, Uses, &c.—The wild carrot is a native of temperate climates, and in the Himalaya grows to the height of six feet. It is called in Sanskrit *Garjara*, and has probably been in cultivation in India from a very remote period. There is a custom amongst the Hindu women of presenting trays containing carrots or radishes along with different kinds of fruit, green gram (*Cicer arietinum*) and sweetmeats, especially those made from Sesamum seeds, at the festival of *Makar Sankránti*, when the sun is worshipped upon his entry into the sign of Makar (Capricorn). These offerings are made upon the second day of the festival, which is called Kar, to friends and relations. In the temple of Apollo at Delphi, radishes were offered upon golden plates as typical of nutriment, and the Indian offering appears to have the same meaning. The

Greeks cultivated the carrot (σταφυλίνος) and also the Romans who called it *Pastinaca erratica*. It is clearly described by Dioscorides, and his commentator Marcellus Vergilius remarks that Pliny says "Est et quartum genus in eadem similitudine pastinacæ nascens, quam nostri Gallicam vocant, Græci vero daucon." From this we may conclude that the Daucus was like the pastinaca erratica or carrot, but not the same plant. The carrot was also called by the Greeks κέρας from its similarity to a horn; in the old Greek lexicons we read "σταφυλίνος ἄγριος ὃν ἔνιοι κέρας καλοῦσι". The Daucus of the Greeks, according to Dioscorides, was of three kinds, the best or Cretan kind had acrid, white, hairy, odoriferous fruit; the second kind was a plant like Celery, with a pungent taste and aromatic odour; and the third kind had an acrid fruit, having the appearance of Cumin. The first kind is generally considered to have been a species of *Athamanta* growing in Crete. Of the third kind, Gronovius says:—"Daucus tertius Dioscoridis, incolis Zarneb, Melchi, Rauwolf. Hodoep., Pt. I. c. 9, p. 116 et Pt. II., c. 2, p. 146. Seseli Cretense nodosum umbella lutea, Moris. Hist. iii., p. 287, f. 9." (*See Trachydium.*) Apicius, a writer on cookery, about A. D. 230, mentions an edible root called *Carota*, which no doubt was the same as our Carrot; as is also the Gazar of the Persians and the Jazar of the Arabians, which they do not identify with the Daucus of Dioscorides, but with his Staphylinos. The old writers on Materia Medica describe Carrots as hot in the extreme of the second degree, moist in the first, diuretic, laxative, emollient, strengthening the venereal faculty, emmenagogue and antiseptic. A decoction of carrots was long a popular remedy for jaundice in Europe, and the dried peduncle is a favourite toothpick among the Arabs on account of its aroma. In India, the seeds are popularly supposed to cause abortion, and are kept by all the native druggists. In those parts of the country where the root is cultivated, it is used with salt as an antiseptic poultice. In modern medicine the carrot poultice has been superseded by more powerful antiseptics, but the fruits still hold a place among our stimulant diuretics, the action being apparently

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due to the volatile oil which they contain, acting locally upon the vessels or nervous structures of the kidney, during its excretion.

Description.—Fruit somewhat compressed from the back, ovate or oblong; mericarps with the five primary ridges filiform and bristly, the three middle ones at the back; the two lateral on the plane of the commissure; the four secondary ridges equal, more prominent, winged, split into a simple row of spines; channels beneath the secondary ridges vittate. Seed anteriorly flattish. (*Pereira.*)

Chemical composition.—The chief constituents of carrot root are carotin, hydrocarotin, oil, sugar, pectin, nitrogen compounds and a little volatile oil. Carotin is a crystalline ruby-red, tasteless, neutral substance, said to be probably formed by oxidation from hydrocarotin, which is a colourless substance. Landsberg describes the essential oil of the fruit as pure yellow, of an agreeable carrot odour and acrid taste; sp. gr. at 20° C., 0·8829. It is levogyre, free from sulphur or nitrogen, and acid in reaction from the presence of acetic acid. The two principal constituents are a terpene belonging to Wallach's pinene group, and an oxygenated body $(C^{10}H^{18}O)$ standing in near relation to cineol (eucalyptol).

TRACHYDIUM LEHMANNI, *Benth. et Hook. f.*

Fig.—*Trans. Linn. Soc. 2 Ser. Bot., Vol. iii., Pt. I., pl.* 11.

Hab.—Persia.

Vernacular.—Shekákul (*Pers., Indian bazars*).

History, Uses, &c.—Shekákul or Sháshkákul, now spelt with the Arabian *káf*, is a Persian word. It is explained in the Burhán as the wild carrot root, the touch of which is supposed to cause a pregnant woman to abort. Haji Zèin-el-attàr says that the plant is called *Kirs-giyah* "bear's wort" in Persian, and a kind of it at Shiráz *Badrán*; he describes the foliage as like that of anise or fennel, and says that the flower is yellow and pubescent. Ibn Sina mentions Shekákul as an aphrodisiac, but gives no description of it. Other Arabian physicians give a similar account of it, and quote Dioscorides as an authority for its use in dropsy as a diuretic (cf. Diosc. *sub-voce* καυκαλις). The Mahometans identify the drug with the Caucalis of Theophrastus, Dioscorides, Galen, Nicander and Oribasius; the best is said to be that which comes from Egypt, and is heavy and of a yellowish-brown colour. Theophrastus classes caucalis among the ἀρουραιον or weeds of cultivation, and Galen says that it has the same taste and properties as Daucus. Pliny notices it as an edible plant, and attributes to it a number of properties not mentioned by the earlier Greek writers. Gronovius in his *Flora Orientalis* has the following notice of Shekákul:—"Tordylium orientale, Secacul Mauris, Rauwolf. Hodoep. Pt. iv., t. 13. Sisarum Syriacum, Bauh. Pin. 155. Apium Syriacum radice ampla eduli, Moris. Hist. iii., p. 292. Secacul Arabum, Pastinaca Syriaca, Germanis gerelen, sive Sisarum species. Dalech App. 23. Ic., p. 24. Cresit juxta sepes et hortos urbis Halepi, locis præsertim apricis et sub arboribus." Sheik Dáwood of Antioch describes shekakul as like a small carrot and of a sweetish taste; he says we call the plant حرض ا لنيل (Hard-un-nil). It would appear that in Western countries at least two species of Tordylium, one growing in Syria (*cf. Jacq. Vind.* 1, *t.* 54) and one in the Levant (*cf. Cam. Hort.* 37, *t.* 11,) have been used as shekákul, but whether either of these plants was the caucalis of the Greeks it is impossible to say. In Persia, *Trachydium Lehmanni*, a very nearly allied plant, produces the shekakul of Asia. Aitchison, when travelling in the Badghis district with the Afghan Boundary Commission, observed the roots of this plant being collected for export to India as shekákul.

Description.—A root of the shape and size of a small carrot, with a conical leaf-bud rising from the crown; externally it is wrinkled and longitudinally furrowed, and is of a light brown colour; internally it is white, starchy and friable; taste amylaceous and sweetish.

Buzidan.—*Caucalis orientalis*, the βουσαιδαν and μπουσαιταν of the later Greek physicians, is closely allied to Shekakul, and is con-

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sidered by Haji Zein-el-attar to be the καυκαλις of Galen. After a discussion in which he says that the true drug comes from Egypt, he concludes by saying that women call this drug and Shekákul, *Shirza* (*shir* milk, and *za* begetting). A drug considered by some to be identical with *buzidán*, and by others to be only similar to it, is called by the Arabs Mustanjil and Uruk-el-bid (hen's root), and an English name for *Caucalis daucoides* is hen's claw. For further information concerning Buzidán, see *Tanacetum*. Another kind of Shekákul is occasionally met with in India; it is a shrivelled rhizome of a light brown colour, marked with transverse scars like Galangal, the taste is sweet and gummy; when soaked in water it swells greatly, becomes quite soft, and is easily cut like preserved ginger. The drug comes from China.

PRANGOS PABULARIA, *Lindl.*

Fig.—*Wall. Pl. As. Rar. ii.*, 7, *t.* 212.

Hab.—Thibet, Cashmere.

Vernacular.—Prangos (*Thib.*), Komal (*Hind.*), Fiturasaliyun (*Indian Bazars*), Badián-i-kohi (*Afghan.*).

History, Uses, &c.—Sanskrit writers mention a plant called Komal and Avi-priya, or "dear to sheep," which is probably *P. pabularia*. In the first quarter of the present century this plant created considerable interest in England. Mr. William Moorcroft, a veterinary surgeon of the Bengal Army, had heard that it was an important factor as a food for cattle, and was occasionally used as a medicine. When on an expedition in 1822 to Upper Assam, for the purpose of opening trade relations with the Chinese authorities at Ela, he made an excursion to Draz, in order to collect specimens of the plant and to study its use as a fodder plant by the natives. The plant which hitherto had been unknown to botanists, was sent to the Director of the Horticultural Society of London as deserving special attention as a fodder plant of particular value, well worthy to be cultivated in England and her colonies for the following reasons:—In its native country the dried plant

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is used as a winter fodder for sheep and goats; it is described as being heating and fat producing, besides being a reliable remedy against the dangerous *Fasciola hepatica*, which often causes the death of thousands of sheep, especially after a wet autumn. Mr. Moorcroft drew special attention to the fact that the plant possessed a remarkable vital force, and thrived well in very poor soil without requiring culture or manure.

Only one bad quality was ascribed to it, *viz.*, its having been observed that horses fed on its fruit suffered frequently from inflammation of the eyes and were sometimes subject to temporary blindness. Its cultivation was then tried in various colonies, especially at the Cape, but it seems that the great advantages expected from it were not realised, for no later information is available.

As a medicine Prangos commands a certain amount of interest, its fruit being sold by Mahometan druggists in India under the name of Fiturasaliyun as a substitute for the Petroselinon or Rock parsley of the Greeks, and Karafs-el-jibali of the Arabs, a plant which has not been identified, and which is described by Dioscorides as having fruit like Ammi, and as being carminative, diuretic and emmenagogue.

The late Dr. Royle was of opinion that Prangos was probably the kind of Silphium mentioned by Arrian, the historian of the campaigns of Alexander the Great, who records that in the part of the Caucasian mountains which corresponds to the present Hindu Kush, only pines and silphium grow, and as the country is inhabited by a numerous people keeping large flocks of sheep the silphium acquires great importance. Its smell attracts the animals from afar—they feed on the flowers and also dig up the roots and eat them. Of the root, which measures from 18 to 22 inches in length, a fine illustration will be found in Wallich. It must not, however, be forgotten that *Ferula ovina*, Boiss., is greedily depastured by sheep, and may have been the silphium of Arrian.

Description.—The fruit consists of a pair of mericarps about ¼ inch long, which together form an elongated oblong

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body crowned by the stylopodium and calycinal teeth; each mericarp has five very prominent convoluted ridges, and measures 5·8 m.m. in length, and 3·4 m.m. in breadth, the colour is a dirty yellow; under pressure the fruit separates into two halves which remain attached to the carpophore. Secondary ribs are not present. Under the microscope a transverse section of the mericarp shows five large irregularly formed ribs traversed by as many bundles of vessels, two more bundles are to be found on each side of the narrow uneven fissure surface. The rest of the tissue consists of parenchyme cells. The pericarp incloses the seed, which is surrounded by many, large, oval-shaped oil vessels, about 40 in number. This cell-line bends itself on both sides towards the interior, thus giving the seed the appearance of a horseshoe. The oil vessels are filled with a yellowish-brown oil, having an odour of caraways. The endosperm consists of a series of rows of many-sided cells, containing a fatty oil and grains of aleurone; it surrounds the embryo, which is dark brown and rather large. Starch is not present. (*H. Lojander Archiv. d. Pharm.* 1887.)

Chemical composition.—An examination of the air-dried fruit resulted in the detection of the following constituents:—

An essential oil.
Traces of fixed oil.
Resins.
Traces of an alkaloid.
Quercitrin in large amount.
An ethereal salt of valeric acid.

Sixty pounds of the fruit were distilled with water in two portions, the water from the distillate of the first distillation being used with the second portion of fruit. The oil was almost entirely soluble in the water of the distillate, and had to be separated by shaking with ether. The yield was very small, about half an ounce. The ethereal oil recalled both the odour of menthol and xanthoxylon oil with an after odour of caraways; it was a mixture of more than one oil, but the amount at our disposal was not sufficient to admit of thorough fractional distillation: it was lighter than water, and after distillation with water, the colour was slightly yellow. With reagents it afforded the following colour reactions:—Bromine dissolved in chloroform deep dirty red; alcoholic hydrochloric acid yellow; concentrated sulphuric acid deep orange red; concentrated nitric acid deep red. Treated with solid iodine some heat was developed, but no marked reaction, the iodine freely dissolved; with Fröhde's reagent a deep red was produced, rapidly changing to deep blue. Sulphuric acid and ferric chloride gave a dirty red. Picric acid dissolved in the oil easily in the cold. No crystals separated on cooling to 1°·5 C. The alkaloid afforded marked precipitates with alkaloidal reagents:—concentrated nitric acid yellow; sulphuric acid brown: no reaction with ferric chloride. An alcoholic extract was agitated with ether, and after driving off the ether, the ethereal extract was heated with caustic soda, when an odour was developed very similar to that of otto of roses.

FERULA ALLIACEA, *Boiss.*

Hab.—Persia. The gum-resin.

Vernacular.—Hing (*Hind.*, *Beng.*), Káyam, Perun-gáyam (*Tam.*), Inguva (*Tel.*), Ingu (*Can.*), Vagárni, Hing (*Guz.*).

History, Uses, &c.—The old Greek and Latin writers on Materia Medica mention two kinds of *Silphium*—one good or sweet, and the other fetid. Theophrastus in his History of Plants (vi., 3), speaks of two varieties, *of the stem* and *of the root.* He says: ὁπόν δὲ διττὸν ἔχει, τὸν μὲν ἀπο τοῦ καυλοῦ τὸν δέ ἀπὸ τῆς ῥιζης, δί δ' καλοῦσι τὸν μὲν καυλίαν τὸν δε ῥιζιαν. Dioscorides mentions two kinds, one coming from Cyrene and the other from Asia. Some consider the silphium of Cyrene to have been entirely different from our Asafœtida, but from a passage in Strabo this does not appear to have been the case. He says:—ὁ Μηδικὸς καλόυμενος, ὀπὸς ὀυ πολὺ λειπὸμενος του Κυρηναικου. Pliny's account of silphium or laserpitium is very confused, but he has collected some information which we now know to be correct. N. Myrepsicus appears to be the first writer who mentions the name ἀσαφίτιδα, which he says is an Italian name for the σκορδολάσαρον of the Greeks of his day. In the Rudens of Plautus (B. C. 220) the scene of which is near Cyrene, frequent allusion is made to the growth of Laserpitium there, and the preparation and export of the gum-resin, as forming the staple article of trade. The Greek and Latin authors agree in saying that the silphium or laser of Cyrene was the best, but from the works of Pliny and Scribonius Largus we learn that it was almost if not quite unobtainable in their time. Pliny relates that a single plant was presented to the Emperor Nero as a curiosity. The gum resin of *F. alliacea* is the Hing of the natives of India, the other kind being seldom used by them. In Sanskrit it is called Hingu, and is said to be so called from its killing or overpowering all other odours. In the Nighantas it bears various synonyms, amongst which may be mentioned Balhika, "coming from Balkh"; Rámatha, Bhúta-násana, "destroying demons"; and Sula-násana, "removing pain in the stomach"; it is described as hot, digestive, appetizing, pungent; a remedy for phlegm, rheumatism, griping, flatulence, diseases of the belly, satiety and worms. It increases the secretion of bile.

Hindu medical writers direct it to be fried before being used. It is in great repute as a condiment among vegetarians, also as an antispasmodic in nervous affections; taken daily it is thought to ward off attacks of malarial fever.

Asafœtida must have been used in India from a very remote period, as the earliest Sanskrit writers mention it.

The plant is called Jatuka on Játuka, a word derived from Jatu, "gum or lac"; it is described as a fragrant plant. Of the Mahometan writers on Materia Medica, Ibn Sina mentions two kinds of Asafœtida—*tyib* (good) and *muntin* (fetid), but gives no description of them. Ali Istakhri, who also lived in the 10th century, states that the drug is produced abundantly in the desert between Sistan and Makran, and is much used by the people as a condiment. The geographer Edrisi, who wrote about the middle of the 12th century, asserts that Asafœtida, called in Arabic Hiltit, is collected largely in Western Afghanistan. Haji Zein the druggist, in the 14th century, tells us that the two kinds of Asafœtida are produced by two different plants, the black and the white *Anjudán*, and that the later plant produces the kind known as *tyib* (good). Mir Muhammad Mumin of Shiraz, who wrote in the 17th century, remarks that the Asafœtida known as *tyib* has a reddish colour, and is produced by a plant vulgarly known as Kulah-par (cap-leaf), that known as *muntin* has a disagreeable odour like a leek, and is called at Ispahan Angusht-gandah, "stink finger." Aitchison, who travelled in Eastern Persia, and the neighbouring districts of Beluchistan and Afghanistan, with the Afghan Boundary Delimitation Commission (1884—85) found that the name *Kema* (کما) was applied generally by the peasantry to the large umbelliferous plants in those parts, the Asafœtida plant being distinguished as Anghuzah-kema and the Ammoniacum as Kandal-kema. The primary meaning of this word in Persian is a sleeve, and there can be no doubt that the similarity between the large sheathing petioles of these plants, and the loose Persian sleeve has suggested the comparison. It would appear then that the kind of Asafœtida called *tyib* by the Arabs and their followers is the drug of European commerce, the produce of *Ferula fœtida*, Regel, and not that of *F. alliacea*, Boiss., which produces the Hing of India. In describing the medicinal properties of the drug, the Mahometan physicians closely follow Dioscorides.

The flowering stems of the Asafœtida plants are eaten as a vegetable, as stated by Pliny. Aitchison notices their use for this purpose, and Dr. Peters forwarded to one of us the flowering stem of *F. fœtida*, Regel, which he had purchased in the bazar at Quetta.

Guibourt (1850) was the first European writer to point out the difference between the Asafœtida of India known as *Hing* and that of the European Pharmacopœias which is called in India *Hingra*. Vigier, *Gommes-résines des Ombellifères* (1869) calls *Hing* Asafœtida nauséeuse. We are indebted to Mr. Ardeshir Mehrban, a merchant of Yezd, for most of the following particulars regarding the source of this drug. Mr.

Ardeshir, having himself visited the hills where the plant grows, was able to speak from personal observation. The plant which produces the Asafœtida used in India (Darakht-i-Anghuzeh-i-khális) grows wild on the hills of Khorasán in very stony ground. The hill-men collect the gum-resin, taking an advance from the merchants. The time for collecting it is in the spring. The plant is not nearly so large as that which produces the Asafœtida of European commerce (Darakht-i-Anghuzeh-i-Lári), the diameter at the crown of the root being seldom more than two inches. The collectors protect each plant by building a small cairn of stones round it; they also remove the soil from the upper portion of the root, making a kind of circular basin. When the stem begins to grow it is cut off, and the upper part of the root being wounded, a small quantity of very choice gum is collected, which seldom finds its way into the market. Afterwards a slice of the root, about ¼ inch thick, is removed every two or three days with the exudation adhering to it, until the root is exhausted. The collected mass, consisting of alternate layers of root and gum-resin, when packed in skins (in quantities of about 100 lbs.) forms the *Hing* of Indian commerce; it is imported into Bombay in large quantities (about 2,500 cwts. annually), and is valued at the Custom House for assessment at Rs. 55 per cwt., commercial Asafœtida (Hingra) being only valued at Rs. 20. Early in 1874, the late Mr. Hanbury was kind enough to forward to one of us the proof-sheets of the article upon Asafœtida in the *Pharmacographia*, with a request for further information upon the subject. Unfortunately this could not be obtained in time for publication in the first edition of that work, as it involved sending to Persia for specimens of the plant and drug. In August, 1874, through the kindness of Mr. Ardeshir Mehrban, the first box of specimens was obtained, collected in the neighbourhood of Yezd. It contained—1*st*, the fresh root, with gum-resin adhering to the broken portions, and from which, upon section, a further exudation took place, at first opaque and milky, but drying in the course of a day or two into a light brown translucent substance;

2nd, the flower stem with flowers and very immature fruit; 3rd, the leaves. The plant arrived in a broken state, and was forwarded to Mr. Hanbury. Upon its receipt, he wrote:—"This morning I have devoted to the Asafœtida plant, and to a comparison of it with the figures and descriptions published by Borszczow, Balfour, and Hooker; but to decide on its botanical name is at present a difficult, if not impossible, task. I suppose it to be either the Narthex of the Edinburgh garden, or the Scorodosma of Borszczow, admitting for the moment that these are two good species; but the specimen does not furnish all the characters requisite for a strict comparison. I cannot tell whether the plant has the great sheathing petioles that form so striking a feature of the Narthex, nor is it possible to say whether the flower stem bore umbels arranged in a tall regular obelisk as Narthex, or crowded towards the summit as in Scorodosma. The foliage might do for either plant, though in having shorter segments it better agrees with the latter. The inflorescence which I have soaked and dissected consists of fertile female, and abortive flowers, none staminiferous. They are remarkably glabrous, not pubescent, as in Borszczow's plant; but this is of small moment."

Early in 1875, another box of specimens, with ripe fruit and a large supply of leaves, was obtained. In acknowledging it, Mr. Hanbury wrote:—"The box containing the Asafœtida plant arrived on the 29th January in excellent order, and its contents have given me great pleasure. The large plant though it had been rudely broken up and stuffed into a narrow space, proved to be fairly perfect; and by soaking in cold water I was able to restore it to shape, and then to fix it together so as to make a really beautiful specimen, measuring three feet six inches in height. The leaves, also, by soaking them and taking some pains, form very decent herbarium specimens, and there are enough of them to supply several collections. But the chief point with me has been to determine the plant. From the foliage, the pink colour of the stem, and the size of the fruit, I judged it might be the *Ferula alliacea* of Boissier; but there being no specimen of this at

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Kew, I had to transmit a portion to *M.* Boissier, in Switzerland. His reply was definite. The plant from Yezd agrees in foliage exactly with *F. alliacea*, in stature, size of fruit, and other respects; but the fruit has a broader margin than in *M.* Boissier's specimens. However, *M.* Boissier thinks it may be set down as that species, a conclusion in which I entirely agree. *Ferula alliacea* was previously known to me only by description. You will observe that we have named it in the *Pharmacographia* as a possible source of Asafœtida. I have thought it right to make a wide distribution of the fine supply of seeds with which you have favoured me, and I have therefore sent packets to the Botanical Gardens of Kew, Edinburgh, Oxford, Paris, St. Petersburg, Bern, Strassburg, Florence, Pisa, Naples, Palermo, Athens, and to botanical friends on the Mediterranean Coast, in South Africa, and a few other places. As the seeds seemed fresh and good, I am in hopes that many plants may be raised."*

Chemical composition.—According to Hirschsohn, Asafœtidas may be divided into two groups—*viz.*, those which yield umbelliferon amongst other products upon dry distillation, and those which do not. The first group of umbelliferon yielding samples, to which the European commercial Asafœtidas belong, is distinguished by the alcoholic tincture being precipitated by acetate of lead and the fluorescence of the sulphuric acid solutions. The second group to which the Bombay kind belongs are not precipitated by acetate of lead, and their sulphuric acid solutions are not fluorescent. The turning of a red colour on exposure to light, and the malachite-green spots produced by nitric acid (first observed by Flückiger) also distinguish the common Asafœtidas from the Indian; it may also be particularly mentioned that stem-remains are found in some kinds of common Asafœtida, while the Bombay kind always contains slices of roots.

Petroleum-ether, besides extracting the essential oil, extracts a non-volatile substance which greases paper. The

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* For a review of the botanical literature of the Asafœtida plants, see Holmes in *Pharm. Journ.* 3rd Ser. xix., 21-34; 41-44; 365-368.

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extractive matter can be used to distinguish the two kinds of Asafœtida, and also to estimate their worth; Asafœtida of an ordinary commercial quality in tears yields at least 7 per cent. extract to petroleum-ether, lump at least 5 per cent. The volatile constituents should not be less than 5 per cent. in tear or 8 per cent. in lump Asafœtida. Good Indian Asafœtida should yield at least 11 per cent. to petroleum-ether, and this residue should not lose more than 6 per cent. when heated to 120° C.

Flückiger has obtained from Hing a reddish essential oil having a specific gravity of 1·02 at 25 C., and deviating 38·8 to the right when examined in a column of 100 millimetres in length.

Commerce.—Hing is known in the Bombay market as Abushaherí Hing; it arrives in skins which contain about 100 lbs.; latterly some boxes have been received. The quality varies greatly, inferior parcels contain an undue portion of the root; in Bombay it is often still further adulterated by mixing it with gum Arabic in different proportions, according to the priced article required. To do this the package is broken up and moistened, the gum is then added, and the whole trodden together by men with naked feet upon a mat. When sufficiently mixed, it is sewn up in skins to imitate the original packages. Recently adulteration with sliced potato has been observed. Hing of good quality is worth about Rs. 80 per cwt. in Bombay.

FERULA FŒTIDA, *Regel.*

Fig.—*Bentl. and Trim.*, *t.* 127; *Trans. Linn. Soc. 2d. Ser. Botany, Vol. iii., Pt. i., pl.* 12, 13, 14.

Hab.—Persia, Afghanistan. The gum-resin.

Vernacular.—Hing (*Hind.*), Hingra (*Guz.*), Káyam, Perungáyam (*Tam.*), Inguva (*Tel.*), Ingu (*Can.*)

History, Uses, &c.—Commercial Asafœtida is collected from this plant in Western Afghanistan and Persia; in May;

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the mature roots begin to send up a flowering stem, which is cut off and the juice collected in the manner described by Kæmpfer, who witnessed its collection in the province of Laristan in Persia. It was long supposed that commercial Asafœtida was the produce of *F. Narthex*, Boiss., a Tibetan plant which was discovered by Falconer in Astor, but there is no evidence of the drug ever having been collected from it. In May, 1884, Dr. Peters, of the Bombay Medical Service, when stationed at Quetta, observed the flowering stem of an Asafœtida plant which was being offered for sale in the bazar as a vegetable by the Kákar Pathans. Specimens which he kindly forwarded to one of us were identified by Mr. E. M. Holmes as *F. fœtida*, Regel. Dr. Peters also found the dried root of the same plant in the drug shops, and learned that it was the plant from which Asafœtida was collected in Western Afghanistan. These facts were confirmed by Aitchison in May 1885, both as regards the source of commercial Asafœtida, and the use of the flower stalk as a vegetable. In his report upon the Botany of the Afghan Delimitation Commission, he remarks:—"In all stages of its growth, every part of the plant exudes upon abrasion a milky juice, which is collected and constitutes the drug of commerce. The stem in a young state is eaten raw or cooked." Aitchison says that a red clay called Tawah (توة) is mixed with the gum-resin at Herat, a statement which is only applicable to the kind of Asafœtida known in commerce as *Kandahari Hing*, to be presently noticed. Concerning the Láristan plant we are still without exact information, but we think it will prove to be *F. fœtida*. The remarks made respecting the use of Asafœtida by the natives of India under *F. alliacea* are more or less applicable to the present article, which is often imposed upon the poorer classes as a substitute for the more expensive Hing. In modern European medicine, Asafœtida is used as a stimulant and antispasmodic in chronic bronchitis, hysteria and tympanitis; it is often administered in the form of enema, as it is apt to give rise to a sense of weight and heat in the stomach when given by the mouth. Dr. Paolo Negri has reported the successful treatment of two cases of abortion with Asafœtida administered to the extent of one gram daily. In the first case the woman had aborted twice and in the second four times; both patients were free from syphilitic taint, and no cause for the abortion could be detected.

Description.—The best Hingra occurs in tears or flat pieces, upon the under-surface of which particles of sand often adhere; the external surface is yellowish; but the fresh fracture is of a pearly white, which by exposure to the air becomes bright pink and finally dirty yellow. Inferior samples consist of agglutinated tears, with a certain proportion of moist brown clammy gum-resin filling up the interspaces between them. Sometimes the Asafœtida which comes from Persia is a homogeneous soft white mass like clotted cream; these parcels upon exposure to the air develop an unusually bright pink colour. The drug has a powerful but not purely alliaceous odour, and a bitter acrid taste.

Microscopic structure.—In the root, portions of which may sometimes be obtained from a mass of second sort Asafœtida, there may be seen a perfectly regular arrangement of the zones, contrasting strongly with the root of *F. alliacea*. It is like that root remarkable for very large laticiferous vessels, but these are distributed symmetrically, the largest occupying the outer radius of the section.

Chemical composition.—Asafœtida consists of resin, gum and essential oil, in varying proportions, but the resin generally amounting to more than one-half. The authors of the *Pharmacographia* say:—

"As to the oil we have repeatedly obtained from 6 to 9 per cent. by distilling it from common copper stills. It is light yellow, has a repulsive, very pungent odour of Asafœtida, tastes at first mild, then irritating, but does not stimulate like oil of mustard when applied to the skin. It is neutral, but after exposure to the air acquires an acid reaction and different odour; it evolves sulphuretted hydrogen. In the fresh state, the oil is free from oxygen; it begins to boil at 135° to 140°

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C., but with continued evolution of hydrogen sulphide, so that we did not succeed in preparing it of constant composition, the amount of sulphur varying from 20 to 25 per cent.

"We found it to have a sp. gr. of 0·951 at 25° C., and a strong dextrogyrate power. If a drop of it is allowed to float on water it assumes a fine violet hue on exposure to the vapours of bromine.

"The essential oil of Asafœtida submitted to fractional distillation yielded us, at 300°, a considerable proportion of a most beautifully blue-coloured oil. By very cautiously oxidizing the crude oil, we obtained a small amount of extremely deliquescent crystals of a sulphonic acid. Sodium or Potassium decomposes the oil with evolution of gas, forming Potassium sulphide; the residual oil is found to have the odour of cinnamon.

"The resin of Asafœtida is not wholly soluble in ether or in chloroform, but dissolves with decomposition in warm concentrated nitric acid. It contains a little *Ferulaic acid*, crystallizing in iridescent needles, soluble in boiling water; it is homologous with eugetic acid.

"Fused with potash, ferulaic acid yields oxalic and carbonic acids, several acids of the fatty series and protacatechuic acid. The purified resin treated in like manner yields resorcin; and by dry distillation, oils of green, blue, violet, or red tint, besides about ¼ per cent. of Umbelliferon, $C^9H^6O^3$."—(*Pharmacographia*, 2nd *Ed*., *p*. 318). E. Schmidt (*Archiv. der Pharm.* (3) xxiv., 534, 535,) has extracted small quantities of Vanillin from Asafœtida by the following process:—The powdered Asafœtida was repeatedly exhausted with ether, the filtrate shaken up with concentrated hydrogen sodium sulphite solution, and the liquid thus obtained supersaturated with dilute sulphuric acid. After expelling sulphurous anhydride, the extraction with ether and subsequent treatment was repeated, and a third extraction made. After removing the ether by distillation, the resulting vanillin was dissolved in water, and the filtered solution allowed to evaporate over sulphuric acid;

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Kandahari Hing.—This substance appears to have been quite unknown in Europe, until brought to the notice of Professor Flückiger and the late Mr. Hanbury by one of us. We have not as yet been able to obtain authentic specimens of the plant, but for the following reasons we consider it likely that it will prove to be the same as that which produces the officinal drug:—

1. Bellew mentions a very high-priced Asafœtida obtained by wounding the leaf-bud of the plant which produces ordinary Asafœtida; our article is generally mixed with numerous leaf-buds, which have evidently been cut off by a sharp knife; its price is also much higher than that of any other kind.

2. When examining a number of bales of common Asafœtida from Kandahar, we found some of them to contain particles of the more expensive drug, and a large quantity of what appeared to be gum-resin in a transition stage between the transparency of Kandahar Hing and the opacity of the commercial article.

3. A portion of root found in a bale of Kandahar Hing agreed exactly with a piece obtained from a bale of common asafœtida.

4. Aitchison describes the juice of *F. fœtida* as a thick gummy reddish substance, and notices its adulteration with red clay; this adulteration is only found in bales of Kandahari Hing.

Kandahari Hing comes to Bombay in small quantities; it is sewn up in goat skins, forming small oblong bales, with the hair outside. When it first arrives it is in moist flaky pieces and tears, from which a quantity of reddish-yellow oil separates on pressure; the gum-resin also is of a dull reddish-yellow colour, soft, and somewhat elastic, with an odour recalling that of garlic and oil of caraways. By keeping, it gradually hardens and becomes brittle and of a rich red-brown colour; the odour also becomes more purely alliaceous, and approaches that of the commercial kind. This kind of Hing is almost entirely consumed in Bombay by the manufacturers of adulterated asafœtida, its strong odour and flavour make it especially valuable for this purpose. The average value is Rs. 25 per Surat maund of 37½ lbs., but as the bales often contain masses of a red clay, the actual price of the clean gum-resin is much higher.

Commerce.—Hingra arrives in Bombay from Persia and Afghanistan. The Persian is produced in the province of Láristán, and is known to Persian merchants as Anghuzeh-i-Lári; it often arrives in a moist condition, but soon hardens. The latter comes from the country about Herat *viá* Kandahar, and is generally hard and dry. Very fine samples in tears are not uncommon. The stony asafœtida described by Pereira is also met with in India; it is simply a mixture of very fluid common asafœtida with the white sandy soil of the country in which the plant grows; it fetches a very low price, and as far as we can make out, the mixture is made more for convenience of carriage than for the purpose of deception. Besides, when the juice is unusually fluid, it runs out upon the surrounding ground and becomes mixed with the sand. The imports of Hingra into Bombay are about 2,500 cwts. annually from Persia and Afghanistan. Value Rs. 10 to 20 per maund of 37½ lbs. The total imports of Asafœtida of all kinds into British India during the last five years have been 37,306 cwts., the aggregate exports have only been 2,014 cwts.

FERULA GALBANIFLUA, *Boiss et Buhse.*

Fig.—*Trans. Linn. Soc. 2d Ser. Bot. Vol. iii., Pt. i.*, 15, 16, 17.

Hab.—Persia. The gum-resin.

Vernacular.—Jawáshir (*Arab., Ind. bazars*), Gaoshir, Barzhad, Biriz (*Pers.*).

History, Uses, &c.—Besides the plant which is placed at the head of this article, Boissier makes another species, *F. rubricaulis*, to grow in Persia. Borszczow, however, regards it as only a variety of *F. galbaniflua*. He states, though not from personal observation, that its gum-resin, which constitutes

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Persian galbanum is collected for commercial purposes round Hamadan. Aitchison says that *F. galbaniflua* is called in the Badghis territory near Herat *Badra-kema*, and that the fresh plant has an odour like celery. The gum-resin which usually exudes from cracks at the base of the stem is called by the peasantry *Shilm-i-barzad* or *Barzad-i-gaoshir* or *jawáshir;* it is said to be given to parturient women, and to be hung round the house to keep evil spirits away at the time of parturition.

Persian brokers in Bombay state that the galbanum plant is very abundant between Shiráz and Kirman, and there would seem to be no reason to doubt that the Indian market is partly supplied from that district.

The old Hindu writers make no mention of galbanum; Ainslie found that the Tamil physicians were unacquainted with it. In many Mahometan works the notices of galbanum appear to have been copied from Greek writers, the synonyms given being generally Barzad and Kinneh, but Haji Zein in the Ikhtiarát, A.D. 1368, describes two kinds of the drug,—one hard and whitish, and the other soft and yellow, like honey; the latter, he says, is called Jákushi at Shiraz.

The author of the Makhzan-el-Adwiya, speaking of Barzad, says it is called Kinneh in Arabic, Khalbani in Greek,* and Bireja or Ganda-biroza in Hindi, and is the produce of an umbelliferous plant like that which produces Sagapenum; but, he adds, that the drug which he has met with in India under these names is the produce of a tree called Deodar growing in the North of India. His experience accords with that of the present day, the only Ganda-biroza obtainable being the turpentine of *Pinus longifolia*. In India Persian galbanum is known as Jawáshir; on referring to the Makhzan we find this word explained as an Arabic corruption of the Persian Gaoshir. The author says, that it is a fetid gum-resin, and describes its collection from an umbelliferous plant, its

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* Conf. Dios. περι χαλβάνης iii., 88; Theoph. H. P. ix., 1; Pliny 12 56; 24, 13.

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appearance, &c., and with regard to its properties informs us that it is attenuant, detergent, antispasmodic and expectorant, and is prescribed in paralytic affections, hysteria, chronic bronchitis and asthma,* also on account of its supposed stimulant action upon the uterus. Externally it is used as a plaster. In short, he enumerates the uses to which galbanum is generally applied. It appears then that the Mahometan physicians of the East have been in doubt as to the identity of the Persian Jawáshir and the galbanum of Greek writers. In India galbanum is little used, the bulk of what is imported into Bombay being sent to Egypt and Turkey as Jawáshir. It is hardly necessary to add that those writers who have identified Jawáshir with Opoponax can never have seen the latter drug. We have never met with Opoponax in India.

Description.—Persian galbanum as met with in the Indian market is a yellow or greenish yellow semi-fluid substance having an odour between that of Levant galbanum and sagapenum; it is generally mixed with portions of the stem, flowers, and fruit of the plant: in some samples the outline of separate tears may be traced. When kept for some time it gradually becomes quite hard and dry. Occasionally samples, which seem to have been collected in a different manner, find their way to India: these contain slices of root and gum-resin in hard, dry tears, like that of Levant galbanum.

Chemical composition.—According to Hirschsohn, good Persian galbanum should yield to petroleum spirit not less than 65 per cent. consisting of volatile oil and resin, the average yield of Levant galbanum being between 60 and 63 per cent. The amount of ash in Persian galbanum should not exceed 4 per cent., being less than the ash of ordinary lump Levant galbanum by 2 per cent. The best Levant in tears gives the same ash as clean Persian. As a qualitative reaction to distinguish the varieties of galbanum, hydrochloric acid can be used, as it colours the Persian resin yellow-red

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* The Jawáshir pill often prescribed in asthma consists of equal parts of Jawáshir and colocynth pulp rubbed up with honey.

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passing into red, and the Levant different shades of violet. The petroleum spirit-extracts from the Persian sorts give with nitric acid a rose-red colour; those from the Levant sorts different shades of violet. Bromine vapour colours the Persian weakly or intensely violet, but the Levant yellow.

The ether-resin from both kinds of galbanum upon boiling with water, gives indications of umbelliferon.

As to the origin of galbanum, the author believes from its varied behaviour with reagents, the different action of the volatile oils upon polarized light, and the different proportions of volatile oil to the gum-resin, that it is derived from different plants. He also points out that the Levant galbanum occurring in commerce contains no fruit and seldom stalks, but always slices of root, whilst the Persian galbanum always contains fruit and stalks.

According to Messrs. Schimmel & Co., galbanum oil is of a pale yellow colour, and possesses a pronounced odour of the gum. Its specific gravity at 15° C. is 0·914; it boils, apparently without decomposing, between 165° and 300°.

A sample of galbanum, collected from *F. galbaniflua* in Persia by Aitchison, and examined by E. G. Baker in 1886, gave the following results:—

Volatile oil	3·108
Resin soluble in ether	61·200
„ „ alcohol	7·576
Gum soluble in water	17·028
Insoluble matter	10·560
	99·472

Sulphuric acid coloured the gum-resin a dark brown; cold hydrochloric acid hardly affected it, but when boiled the mixture turned a dirty red colour, which was not altered by alcohol. A small portion of gum-resin boiled in water and allowed to cool gave on the addition of ammonia a faint blue fluorescence indicating the presence of umbelliferon; it contained no sulphur. (*Pharm. Journ.*, 1886, *p.* 468.)

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Commerce.—Galbanum is imported from Persia into Bombay. It is collected in the Hari-rud Valley and Bádghis (*Aitchison*); it is also said to be collected between Shiráz and Kirmán. The imports are very irregular, most of it is re-exported to Egypt and Turkey. Average value, Rs. 8 per maund of 37½ lbs.

DOREMA AMMONIACUM, *Don.*

Fig.—*Trans. Linn. Soc. 2nd Ser. Bot. Vol.* iii. *Pt. i.*, 23, 24, 25; *Jaub. et Spach. Ill. Pl. Or.* I., *t.* 40.

Hab.—Persia, Afghanistan. The gum-resin.

Vernacular.—Ushak (*Arab., Pers., Indian bazars*), Kandal (*Afghan*).

History, Uses, &c.—This plant and *D. glabrum,* Fisch et Mey., both natives of Persia, are known to produce a gum-resin, but, according to Aitchison, that of the former plant is alone collected. Of the latter plant he says: It yields a yellow gum-resin; but I did not hear of its being collected; it is called Kema-i-ásp (horse Kema). Dioscorides speaks of ammoniacum as the juice of a narthex growing about Cyrene in Libya,* and it appears to have derived its name from the temple of Ammon. Pliny † derives it from 'Ammos,' sand. Most Greek and Latin writers on medicine mention its use in fumigation, and speak of it as *Thus Libycum, Ammoniacum thymiana,* or *Ammoniacum suffimen.* This kind of ammoniacum has now been ascertained to be the gum-resin of *Ferula Tingitana, Linn.*, which grows in Morocco. It was probably the only kind known in Europe in olden times. (*Confer. Pharmacographia, p.* 288.) The time when Persian ammoniacum first came into use cannot be exactly fixed.

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* Diosc. περὶ αμμωνιακοῦ, iii., 89. It had a reputation as a resolvent, especially in enlargements of the liver and spleen. Scrib. Comp. 128, 131. Persian ammoniacum has a similar reputation in India.

† 24, 14.

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It is not mentioned by the Greeks or Romans. Ibn Sina states that Ushak is the gum of the Tarthúth, and is called Lazák-el-dahab (= χρυσόκολλα), because it is used in gilding. His ammoniacum is doubtless Persian, like that of Abu Mansur Mowàjik, a Persian physician of the eleventh century, and of Ansári of the middle of the fourteenth century. The latter writer states that the Shirazí name for Ushak is Badrán. In Bokhara the gum-resin bears the name Kandal. According to Bunge and Bienert, the same name, and Kama, are given to the plant in Persia. Aitchison, who observed the plant in the Hari-rud valley, found it to be known to the natives as Ushak and Kandal-kema. He remarks: "No sooner is the fruit well formed and beginning to ripen than the plant is attacked by some boring insect, which causes the milky juice to escape. This dries into hard blocks, frequently enclosing the fruit."

According to Borszczow, *D. Ammoniacum* is called by the Kirghises Bal-kurai or "Honey-cane." The author of the *Makhzan-el-Adwiya* says that Ushak is an Arabic corruption of the Persian Ushnah or Ooshah, and that the drug is also called Khalbani, and in Arabic Ushajj, Wushajj, Wushok and Lazák-el-dahab. He gives the Greek names as Athánikun, Ammoniakun and Parnaksh, the Egyptian as Kinna, Shak and Kalakh, and the Indian as Kandar. Some Persian writers give Tarthúth as the Arabic and Samgh-i-bal-i-shírín as the Persian name. According to the dictionaries, Bal is the Persian for Tarthúth. Baghdádi tells us that Tarthúth is not the same as ammoniacum. In Bombay the current Persian name is Ushak. Mahometan works on Materia Medica describe the drug as discutient and attenuant; for more particular opinions respecting it the reader may consult the *Makhzan-el-Adwiya*, article Ushak. Sanskrit writers do not mention it. Besides the gum-resin, the root of *D. Ammoniacum* is largely imported into Bombay, and is one of the substances used by the Parsees as incense under the name of *Boi*, a word cognate with *Bu*, or *Bo*, fragrance. It is popularly spoken of as a wood. There can be little doubt that the use of this substance as an incense must date from a very remote period, otherwise the modern Parsees

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would not be at the trouble of importing it into India. Mr. K. R. Cama informs us that the "wood of fragrant trees" is mentioned in the Avesta as a class, and that one wood in particular is named, "*Hadha Náeptanam*," which would mean translated into Persian, "Hamisheh naft," always moist, *i.e.*, green. He says: "In modern days we identify this wood, most likely mistakenly, with Pomegranate wood." It would appear then, that there is no specific description of Boi in the Avesta, but that it is traditionally understood to be one of the fragrant woods mentioned therein. It is this root which was some years ago exported to Europe as Bombay Sumbul, after having been cut up and impregnated with musk. When old and worm-eaten it becomes of a loose and spongy texture, and might easily be mistaken for Sumbul by a superficial observer.

Description.—Bombay is the chief mart for ammoniacum, and it is here that the original packages which come from the Persian Gulf ports are opened and sorted for the various markets.

The bales, generally of matting or coarse canvas, frequently contain all parts of the plant broken up and encrusted with the adherent exudation. Seed in the mature state is separated in large quantities, and is readily eaten by cattle. It would appear then that the collection takes place after the plant has matured its fruit, and that hardly any attempt is made by the collectors to separate the plant from the gum-resin; the latter exudes from every part, even the fruit is coated with it, and perforated by insects in the same manner as the stem.

Ammoniacum is usually sorted into three qualities—large tears, middle-sized tears, and small; the last kind is often carelessly picked, and contains dirt and other refuse. If the drug is kept in Bombay during the monsoon, the tears get soft and unite into a lump.

The roots vary in size, the largest being three inches in diameter at the crown; they are generally more or less forked; the root bark is thin and papery like that of the Sumbul, but the root itself is compact, and has a resinous section. A small

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specimen, powdered and exhausted with boiling water, yielded about one ounce of dark-coloured ammoniacum.

Chemical composition.—The following account is extracted from the *Pharmacographia*.—"Ammoniacum is a mixture of volatile oil with resin and gum. We obtained only ⅓ per cent. of oil, which we find to be dextrogyrate; we failed in obtaining a terpine from it.

"The volatile oil, which is lighter than water, and has the precise odour of the drug, contains, according to our experiments, no sulphur; a similar observation was made by Przeciszewski. Vigier, who obtained the oil to the extent of 1·8 per cent. by distilling the gum-resin with water, asserts that it blackens silver, and that by oxidation with nitric acid, he detected in it sulphuric acid. He states that with hydrochloric acid, the oil acquires a fine violet tint, passing by all shades to black; we failed in obtaining this coloration. By diluting the oil with bisulphide of carbon, and then adding mineral acids, we observed only yellow coloration. The oil diluted with alcohol acquires a red hue with ferric chloride.

"The resin in ammoniacum usually amounts to about 70 per cent. It is separable, according to Przeciszewski, into two substances—the one a resin having acid properties, the other an indifferent resin. He asserts that the indifferent resin when heated yields sulphuretted hydrogen. Our own experiments failed to show the presence of sulphur in the crude drug; and the same negative result has been more recently obtained in some careful experiments by Moss. Water, when boiled with the resin, acquires a yellow hue and slightly acid reaction; the liquid assumes an intense red coloration on addition of ferric chloride.

"Ammoniacum yields no umbelliferon; when melted with caustic potash it affords a little resorcin. The mucilaginous matter of the drug consists of a gum readily soluble in water, and a smaller quantity of about ¼ of an insoluble part, no doubt identical with that occurring in Asafœtida and galbanum. The aqueous solution of the gum of ammoniacum is very slightly levogyre." (*Confer. Hirschsohn Phar. Zeitscrift für Russland, April* 15, 1875, p. 225.)

Commerce.—All the Ammoniacum which reaches Bombay comes from Persia.

Value, about Re. ¼ per lb.

The root is also imported from Persia. Value, Rs. 4 to Rs. 5 per Bombay maund of 28 lbs.

DOREMA AUREUM, *Stocks.*

Fig.—*Hooker's Jour. of Botany, iv.*, p. 149.

Hab.—Beluchistan.

The gum-resin of this plant, gathered by Dr. Stocks in Beluchistan, is described as being an opaque cream-coloured substance, closely resembling in taste, smell and general appearance the ammoniacum of commerce. We have made enquiries for it in the Sind bazars, but cannot find that it is anywhere an article of commerce.

SAGAPENUM.

Vernacular.—No Indian names. Sagbinaj (*Arab, Indian bazars*), Iskabinah (*Pers.*).

History, Uses, &c.—This drug is supposed to be the juice of *Ferula Szovitsiana,* DC., but there appears to be no record of its collection from that plant. Aitchison speaks of *F. Szovitsiana* as a rigid herb, scarcely two feet high; common in the stony country and gravelly plains of the Hari-rud valley, the root stock of which possesses a slight odour of asafœtida. The fruit frequently present in commercial sagapenum is similar in shape to that of *F. galbaniflua,* but larger and of a yellow colour.

Sagapenum was known to the Greeks, and through them the early Arabian writers probably became acquainted with its medicinal properties. Dioscorides speaks of it as the juice of a ferulaceous plant growing in Media, and says that it has an odour between that of silphium and galbanum, whence we may

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infer that the odour of silphium was alliaceous. Pliny says that it is used to adulterate laser and galbanum. We see no reason to suppose that the ancient Hindus knew the drug, although Kundel is in some books given as the Sanskrit and Hindí name for it. The author of the *Makhzan-el-Adwiya* gives a sufficiently accurate description of Sagbínaj, and tells us that it is obtained from the district of Mah, near Ispahán. Persian brokers in Bombay state that the drug brought to this market is collected in the country between Shiraz and Kirmán. It is necessary to remark that Persian Sagapenum is distinctly different from what is known as Levant Sagapenum. Mahometan physicians consider Sagapenum to be attenuant and resolvent; when combined with purgatives it is thought to exert its resolvent power upon every part of the system, removing noxious humours; they also value it as an anthelmintic and emmenagogue. For a full account of the diseases in which it is prescribed, we must refer the reader to the *Makhzan-el-Adwiya*, article Sagbînaj. A sagapenum pill is often prescribed in flatulent dyspepsia; it contains equal parts of Aloes, Sagapenum, Bdellium and Agaric. Two to three dirhems are to be taken with warm water.

Description.—Sagapenum generally arrives in Bombay in masses weighing from four to ten pounds, tied up in coarse cloth, but occasionally parcels consisting of fine, dry, separate tears are seen.

The masses are made up principally of tears, which being mixed with a proportion of soft gum-resin, adhere together, forming a brownish-yellow cake; when fresh some of the tears have a greenish tinge, and are more or less opaque, but by keeping they all become brownish-yellow and translucent. The dry tears are always of a brownish-yellow.

The odour is distinctly alliaceous, but in other respects is much like that of Persian Galbanum.

Chemical composition.—Persian Sagapenum and Persian Galbanum closely resemble each other, and the same may be said of Levant Sapagenum and Levant Galbanum. As characters for distinguishing Sagapeum from Galbanum may be used—(1*st*), the presence of sulphur in Sagapenum; and (2*nd*), their behaviour towards petroleum spirit, Persian Sagapenum yielding to it 2 to 5 per cent. and Levant 6 to 12 per cent. of resin, whilst the resinous residue from Persian Galbanum amounts at the most to 0·2 to 0·3 per cent. and that from Levant Galbanum to 1 per cent. (*Confer. Hirschsohn Phar. Zeitschrift für Russland, April* 15, 1875, *p.* 225.)

Commerce.—The quantity annually imported into Bombay varies greatly; most of it goes to London. It is seldom to be obtained in the retail shops. Value, Re. ½ to Re. ¾ per lb.

ARALIACEÆ.

Many species of Aralia are cultivated in gardens in India on account of their foliage. Loureiro tells us that they are used medicinally in Cochin-China, and are aperient, diuretic and diaphoretic. The famous *Ginseng* of China is derived from this family, and our Indian gardeners have discovered antifebrile properties in *Aralia Guilfoylia*, which they have named *Tápmári*, "fever killer." We have found that a syrup prepared from the leaves is a useful expectorant in cough. The leaves of most of the Aralias have a strong odour of Ivy when crushed. *A. Guilfoylia* is the *Frutex aquosus femina* of Rumphius (VI., 51), who states that it reduces heat in fever. *Aralia Pseudo-ginseng*, Benth., *Wall. Pl. As. Rar. t.* 137, is a native of Nepal, Sikkim, Bhotan and the Khasia mountains. Mr. C. B. Clarke considers it to be doubtfully separable from the true Ginseng of Japan, *Panax Ginseng*, C. A. Meyer, which differs by having broader, more obovate, less bristly leaves, and not by the characters relied on by Meyer. The Indian examples show every form of root stock and tuber attributed specially to *P. Ginseng* and to *P. quinquefolius*, Linn.; the scale at the base of the stem is persistent even in some of Wallich's specimens. (*Fl. Br. India.*) Ginseng enjoys in its native country the reputation of a panacea, and especially of being aphrodisiac. The affections for the cure of which it is most esteemed, are such as are usually treated by aromatic stimulants, including dyspepsia, vomiting, and nervous affections. It is used as a masticatory and also in infusion, and is occasionally brought to India by the Chinese.

Description.—Ginseng root is fusiform, 4 to 6 inches long, with a rounded head, closely annulate, and with few wrinkles above, dividing below into two, or occasionally three, branches of even size. The branches are not, or are but slightly, annulate, and are longitudinally wrinkled. The root is externally of a brownish-yellow colour, internally white, breaks with a short and mealy fracture, and has a faint sweetish odour and a sweet slightly aromatic taste. The transverse section shows a thick bark, with numerous scattered brown-red resin-cells, and in older roots is radially striate from the bast-wedges; it is separated by a brown cambium-line from the central portion, which consists of linear wedge-shaped yellowish wood-bundles and broad medullary rays.

Chemical composition.—Besides starch, gum, albumen, and resin, S. S. Garrigues (1854) isolated a sweet principle, *panaquilon*, $C^{12}H^{25}O^{9}$, by adding to the syrupy infusion a concentrated solution of sodium sulphate and dissolving the precipitate in alcohol. It is yellow, amorphous, sweet, insoluble in ether, and precipitated by tannin. Concentrated sulphuric acid dissolves it with a purple-red colour, converting it at the same time into *panacon*, $C^{11}H^{19}O^{4}$, which is white, tasteless, and insoluble in water and ether, but soluble in alcohol.—(*Stillé and Maisch.*)

We have examined the leaves of *Aralia Guilfoylia*, which have an odour like fœnugreek, due to an odorous principle which was dissolved out by ether and stronger alcohol, but could not be obtained by distillation. The distillate was slightly acid, and contained a white fatty substance like a stearopten having quite a distinct odour from that of the drug. The aqueous solution of the ethereal extract was viscid, partly soluble in water, and the portion soluble gave the usual reactions for an alkaloid. The alcoholic extract was very sweet and contained a large quantity of a body readily reducing Fehling's solution; the extract also contained an organic acid and ammonia, an alkaloid, and a soluble chloride in the portion soluble in water. The resinous part of this extract insoluble in water formed a gelatinous magma with that menstruum, and instantly dissolved, without deepening of colour, with the aid of an alkali. The aqueous extract was sweet and had the peculiar odour of liquorice. It contained sugar and an organic acid similar to that found in the spirit extract; it gave a precipitate without colour with ferric chloride, mixed clear with gelatine, and precipitated with the mineral acids as a jelly-like substance. The ash amounted to 15·2 per cent., and consisted mainly of alkaline salts. The alkaloid contained in these leaves is not bitter.

CORNACEÆ

ALANGIUM LAMARCKII, *Thwaites.*

Fig.—*Wight Ic., t.* 194; *Ill., t.* 96; *Rheede Hort. Mal. iv., tt.* 17, 26.

Hab.—Throughout India. The roots, bark, seeds, and leaves.

Vernacular.—Dhera, Akola, Ankul (*Hind.*), Ankul (*Guz.*), Ankoli (*Mar.*), Ankalige (*Can.*), Bagh-ànkura, Dhalákura (*Beng.*), Azhinji-maram, Alangi (*Tam.*), Uduga-chettu, Ankolam-chettu (*Tel.*).

History, Uses, &c.—This tree, in Sanskrit Ankota, Nikochaka, and Gupta-sneha, "the oil of which is hidden," is described in the Nighantas as bitter, mucilaginous, pungent, light and aperient; it expels worms, wind, phlegm and poison. The fruit is cold and sweet, and begets phlegm, it is strengthening and aperient, and cures wind, bile, inflammations, phthisis and skin diseases. Rheede says:—"Cæterum arbor hæc varias ob causas emblema Regiæ majestatis Malabarensibus

habetur, quarum præcipua est, quod flores diademati Imperiali haud absimiles, rigidis inhereant spinis. Insuper succus ex arboris radice expressus, et exhibitus vermes necat, nec non biliosos ac pituitosos humores per alvum expurgat, et aquas hydropicorum ducit."

Mr. Moodín Sheriff has drawn attention to the emetic properties of the bark in the *Pharmacopœia of India*. He says:—"It has proved itself an efficient and safe emetic in doses of fifty grains; in smaller doses it is nauseant and febrifuge. The bark is very bitter, and its repute in skin diseases is not without foundation. If it is continued for a sufficient period its influence over them is greater than that of *Calotropis gigantea*." Mr. Moodín Sheriff, in a further report upon this drug (1883), states:—"It is a good substitute for Ipecacuanha, and proves useful in all diseases in which the latter is indicated, except dysentery. As a diaphoretic and antipyretic it has been found useful in relieving pyrexia. Dose as a nauseant, diuretic and febrifuge, 6 to 10 grains of the root bark; as an alterative, 2 to 5 grains; it is given in leprosy and syphilis; the natives consider it to be alexiteric, especially in cases of bites from rabid animals."

Dr. S. Arjun (*Bomb. Drugs*, p. 70,) states that the leaves are used as a poultice to relieve rheumatic pains.

The reports of several medical officers are quoted by Dr. Watt in his Dictionary of the Economic Products of India, but none of them, except Mr. Moodín Sheriff, appear to speak from personal experience.

Description.—Root heavy, wood close-grained, yellow, having an oily appearance; it and the bark turn of a dirty-green colour on being touched with a solution of perchloride of iron. The bark is of a cinnamon-brown colour, the external surface separating in thin corky flakes, which are studded with small circular warts. The inner layers are compact and of the same colour. Taste bitter, odour rather nauseous. The fruit is astringent and acid, $\frac{5}{8}$ by $\frac{3}{8}$ of an inch,

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black, closely pubescent or finally glabrous; endocarp bony. The leaves are 3—6 by 1—2 inches, oblong or elliptic, acute or subobtuse, base unequal, above nearly glabrous with pubescent nerves, beneath hairy and often with tufts of hair or hollow glands in the axils of the primary nerves.

Chemical composition.—The most interesting principle present in the roots, is a very bitter non-crystallizable alkaloid which we have provisionally called *Alangine*. It is soluble in alcohol, ether, chloroform, and acetic ether, and practically insoluble in water. With the mineral acids, and with acetic, tartaric, and oxalic acids we failed in obtaining crystallizable salts. From an alcoholic solution, on spontaneous evaporation, it occurs as a yellowish, varnish-like deposit wholly destitute of any crystalline structure. From an acid solution it is precipitated in white flocks by the addition of alkalies, and with the ordinary alkaloidal re-agents it affords marked precipitates. With concentrated sulphuric acid, alone or with the addition of potassium bichromate, no special colour reactions were observed. Fröhde's re-agent gave an indigo-blue coloration in the cold, and on gently heating and then cooling a very light brilliant blue resulted. With nitric acid a reddish brown solution was yielded, and on gently warming it nitrous fumes were evolved and the liquid became lighter in colour. A platinum salt was prepared which contained 20·703 per cent. of platinum on the salt dried at 100° C.

CAPRIFOLIACEÆ.

VIBURNUM FŒTIDUM, *Wall.*

Fig.—*Wall. Pl. As. Rar., Vol. i., t.* 61.

Hab.—Burma. Cultivated in India. The leaves.

Vernacular.—Narvel (*Mar.*), Naruval (*Can.*).

History, Uses, &c.—Though a native of Burma this shrub is found in cultivation throughout Western India.

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It appears to be confounded with, and to be used for the same purposes as *Premna coriacea*, Clarke, and other strong-smelling Premnas which bear the Sanskrit names of Sriparna and Jaya. How and when *V. fœtidum* was introduced into India is unknown; it seldom flowers and fruits here. It is customary for Hindu women who have been confined to hang a branch over the door of the room in which they lie, as a protection against evil spirits and post-partum hæmorrhage. Another superstition is, that if seven pieces of the stem of this plant are knotted into a thread made from cotton picked by a virgin, the necklace thus formed will cure scrofulous glands. A cake made from the flour of eighteen different kinds of grain with Narvel juice, is scraped while hot on one side, well moistened with the juice and applied to the head in headache. A wineglassful of the juice of the leaves is administered internally in menorrhagia daily, also in post-partum hæmorrhage. It is remarkable that *V. prunifolium*, an American plant, is also said to be useful in all uterine diseases characterised by loss of blood and in threatened abortion. (Cf. *Les Nouveaux Remèdes. Sept.* 8, 1888; *Etude sur l'emploi thérapeutique du Viburnum prunifolium, par le Dr. Debierre.*)

Two of the Viburnums are common garden shrubs in Europe, *V. Opulus* and *V. tinus*, the former is probably the *θραυπαλος* of Theophrastus; the fruit is edible. The cultivated variety of this plant is the Gueldres Rose, in which the flowers form a white ball. The latter is the well known Laurestine. *V. Opulus* is said to have the same medicinal properties as *V. prunifolium*. (*Purdy, On the use of V. Opulus in dysmenorrhœa and uterine pain. New York Med. Journ., Nov.* 1882.)

Description.—A shrub, leaves variable, usually ovate-lanceolate, serrated, length 1½ to 2 inches, flowers small, greenish white, berries small, ovoid, and of a vivid red colour. All parts of the plant have a powerful unpleasant odour like that of *Premna integrifolia*.

Chemical composition.—The *viburnic acid* of Krämer (1844) obtained from the bark of *V. Opulus* was proved by Monro

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(1845) to be identical with valerianic acid. The *viburnin* of Krämer is a light yellowish substance or whitish powder of a neutral reaction, and of a purely bitter taste; it is slightly soluble in water and more freely so in alcohol. Enz (1863) found in the fruit of *V. Lantana*, a hygroscopic neutral bitter principle readily soluble in water, also valerianic, acetic, tartaric and tannic acids.

The odorous principle of the leaves of *V. fœtidum* is removed by distillation in the form of fetid volatile oil, separating from the distillate in white greasy flakes neutral in reaction. The decoction remaining in the retort had a nauseous animal-like odour, and when filtered, showed the presence of much mucilage by giving gelatinous precipitates with ferric chloride, lead acetate and alcohol. Ether removed the fetid principle together with chlorophyll, some resinous matter, and a trace of alkaloid from the dried and powdered leaves. The alcoholic extract was sweet, with a peculiar sharpness on the palate, and was acid in reaction. The aqueous solution of this extract gave abundant precipitates with potassio-mercuric iodide, iodine solution, tannin and ferrocyanide of potassium, indicating the presence of an alkaloid, which was subsequently confirmed by separating it from this solution by the cautious addition of ammonia or caustic soda. Ammonia added to its solution caused a precipitate of cross-shaped crystals; soda threw down the alkaloid as a whitish powder, which agglutinated into a brown mass soluble in excess of the alkali The alkaloid had a peculiar sharp taste, was soluble in ethylic and amylic alcohol and chloroform, and slightly in water and ether. It formed a crystalline sulphate, hydrochlorate and nitrate. It gave no peculiar colour reactions with the strong mineral acids, but dissolved in nitric acid, and the solution when evaporated left a mass of crystals which had a fragrant odour when mixed with water. The alkaloid fused into a reddish mass when heated, and gave off alkaline fumes. The leaves left 12·25 per cent. of white ash when completely ignited.

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RUBIACEÆ.

ANTHOCEPHALUS CADAMBA, *Miq.*

Fig.—*Bedd. Fl. Sylv.* 127, *t.* 35; *Korth. Verh. Nat. Gesch. Bot.* 154, *t.* 48. Wild Cinchona (*Eng.*).

Hab.—Himalaya to Ceylon, wild or cultivated. The fruit and bark.

Vernacular.—Kadamb (*Hind., Beng.*), Kalamb, Nhyu (*Mar.*), Vella-kadamba (*Tam.*), Kadambe (*Tel.*), Kadavála-mara (*Can.*).

History, Uses, &c.—This tree is sacred to Káli or Parvati, the consort of Siva; it is the *Arbor Generationis* of the Maratha Kunbis, and a branch of it is brought into the house at the time of their marriage ceremonies. The tree is planted near villages and temples, and is held to be sacred. In Sanskrit it is called Kadamba or Kalamba, and has also many synonyms, such as *Sisu-pála*, 'protecting children'; *Hali-priya*, 'dear to agriculturists,' &c. The Kadamba blossoms at the end of the hot season, and its night-scented flowers form a large, globular, lemon-coloured head, from which the white clubbed stigmas project. They are compared by the Indian poets to the cheek of a maiden mantling with pleasure at the approach of her lover, and are supposed to have the power of irresistably attracting lovers to one another. This idea is expressed in the following couplet of the Saptasatika of Hála:—"Sweet-heart, how I am bewitched by the Kadamba blossoms, all the other flowers together have not such a power. Verily Kama wields now-a-days a bow armed with the honey balls of the Kadamba." The flowers are fabled to impregnate with honey the water which collects in holes in the trunk of the tree. Beal, in his *Catena of Buddhist scriptures from the Chinese*, informs us that according to the Dirghagama Sutra, to the east of mount *Sume* rises a great king of trees called Kadamba; in girth seven yoganas, height a hundred yoganas, and in spread fifty yoganas. M. Sénart (*Essai sur la légende*

du Buddha) says :—"L'arbre de Bouddha sort spontanément d'un noyau de Kadamba déposé dans le sol ; en un moment, la terre se fend, une pousse paraît, et le géant se dresse ombrageant une circonférance de trois cents coudées. Les fruits qu'il porte troublent l'esprit des adversaires du Buddha contre lesquels les Dévas déchaînent toutes les fureurs de la tempéte." (*De Gubernatis.*) The fruit, which is about the size of a small orange, is eaten by the natives and is considered to be cooling and a destroyer of phlegm and impurities of the blood. The bark is considered to be tonic and febrifuge, and its fresh juice is applied to the heads of infants when the fontanelle sinks ; at the same time a small quantity mixed with cumin and sugar is given internally. In inflammation of the eyes the bark-juice with equal quantities of lime-juice, opium and alum is applied round the orbit.

Description.—The bark taken from the larger branches occurs in thick flat pieces, the external surface is grey and studded irregularly with small, prominent corky lenticels ; it shows numerous and extensive light brown scars caused by the separation of portions of bark due to the development of corky layers in its substance. The inner surface and substance of the bark is red and fibrous. Taste bitter and astringent.

Chemical composition.—The bark gave 9·8 per cent. of ash and 18 per cent. of alcoholic extract. The former contained calcium carbonate from the reduction of the oxalate present in the bark, and the latter contained an astringent principle. The extract soluble in water was red in colour, and gave a green precipitate with ferric chloride, a bulky flesh-coloured precipitate with gelatine, and a brick-red deposit with iodine solution. Treated with caustic alkali, a yellowish brown liquor was obtained, which gradually assumed a deep red and gave off the odour of cinchona bark solutions when treated under the same conditions. Boiled with dilute sulphuric acid for one hour a red deposit occurred in the decoction. The extract insoluble in water was for the most part soluble in diluted alkali with a rich red colour and a slight blue fluorescence. The solution

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precipitated with an acid, and the red magma separated and treated with lime water, afforded to the solvent no principle insoluble when acidified. The astringency of the bark is due to an acid similer to cinchotannic acid, and the drug contains a ready formed oxidation product of the nature of cinchona red. No alkaloidal principle is present.

ADINA CORDIFOLIA, *Hook. f.*

Fig.—*Brand. For. Fl., t.* 33; *Roxb. Cor. Pl. I., t.* 53.

Hab.—Throughout the hilly parts of India. The bark.

Vernacular—Haldu, Hardu, Karam (*Hind.*), Bangka, Kelikadam (*Beng.*), Manja-kadambe (*Tam.*), Paspu-kadambe, Dudagu (*Tel.*), Hedde, Yettega (*Can.*), Hedu (*Mar.*).

History, Uses, &c.—This tree is regarded by the Hindus as a species of Kadamba, and is the Dhárá-kadamba or Kalambaka of Sanskrit writers. It is well known in all parts of India for its bitter medicinal bark, and valuable yellow wood, which is used for many industrial purposes. The bark is a popular febrifuge amongst the agricultural classes, and ground into a paste with water it is much used as a local application to the sores and galls to which draught cattle are subject. It is considered to be antiseptic and to prevent the generation of worms in sores.

Description.—The bark occurs in thick curved pieces, externally light grey or dirty white, darkly shaded from the growth of a small Hepatica on its surface. Its inner surface and substance is reddish-brown and fibrous. Taste bitter and astringent.

Chemical composition.—The bark contains the same constituents as that of *Anthocephalus Cadamba.* The red-coloured tincture gave 32 per cent. of dried extract, calculated on the powdered bark. This extract contained an astringent acid like cinchotannic acid, a red oxidized product, a fluorescent bitter principle, but no alkaloid. Starch and calcium oxalate were present in the inner layers of the bark, and calcium

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carbonate constituted the greater portion of the 10·4 per cent. of ash obtained on combustion.

UNCARIA GAMBIER, *Roxb.*

Fig.—*Hunter in Trans. Linn. Soc. ix.*, 218, *t.* 22; *Korth. Verh. Nat. Gesch. Bot.*, *t.* 34; *Bentl. and Trim.*, 139. The extract, Gambier, Pale catechu (*Eng.*), Gambir cubique (*Fr.*).

Hab.—Malacca, Penang, Singapore. The extract of the leaves, and young shoots.

Vernacular.—Chini-Katha or Kath, &c. (*Ind.*) In the Indian languages it bears the same name as Acacia Catechu, with the addition of the adjective Chinese.

History, Uses, &c.—We meet with no account of this substance in Hindu or Mahometan works on Materia Medica. Anslie mentions the drug, but he appears to have been very imperfectly acquainted with it, as in his first volume he describes the different kinds of catechu found in Southern India without noticing Gambier. (*Materia Indica, II., p.* 105.) Flückiger and Hanbury in their *Pharmacographia* remark that:—"If we may credit Rumphius, it would seem that the important manufacture of Gambier had no existence at the commencement of the last century. As to 'Gutta Gambier,' his statements are scarcely in accord with those of more recent writers. We may, however, remark that that name is very like the Tamil Katta Kambu, signifying catechu, which drug is sometimes made into little round cakes, and was certainly a large export from India to Malacca and China as early as the 16th century. That Gambier was unknown to Europeans long after the time of Rumphius, is evident from other facts. Stevens, a merchant of Bombay, in his *Compleat Guide to the Eastern India Trade*, published in 1766, quotes the prices of goods at Malacca, but makes no allusion to Gambier. Nor is there any reference to it in Savary's *Dictionnaire de Commerce* (Edn. of 1750), in which Malacca is mentioned as the great *entrepôt* of the trade of India with that of China and

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Japan. The first account of Gambier known to us, was communicated to the Batavian Society of Arts and Sciences in 1780, by a Dutch trader named Couperus. This person narrates how the plant was introduced into Malacca from Pontjan in 1758, and how Gambier is made from its leaves; and names several sorts of the drug and their prices. In 1807 a description of 'the drug called Gutta Gambier,' and of the tree from which it is made, was presented to the Linnean Society of London by William Hunter.'* A good description of the manufacture of Gambier will be found in the *Pharmacographia*. The process consists in boiling the leaves and young shoots and evaporating the liquor until it crystallizes.

Description.—Gambier is an earthy-looking substance of light brown hue, consisting of cubes about an inch each side, more or less agglutinated, or it is in the form of entirely compact masses. The cubes are externally dark reddish brown and compact, internally of a pale cinnamon hue, dry, porous, friable, devoid of odour, but with a bitterish astringent taste, becoming subsequently sweetish.

Under the microscope the cubes of Gambier are seen to consist of very small acicular crystals. (*Pharmacographia.*) Gambier is also imported into India in the form of small lozenges.

Chemical composition.—In chemical composition Gambier agrees with Kutch. (*See Acacia Catechu.*) Gambier from Singapore has lately been exported in a damp condition causing great inconvenience in the trade. Mr. W. N. Evans has analysed some authentic field and trade samples with the following results:—

	Gambier from field.	Trade Gambier.
Tannin	11·48	14·68
Organic matter	30·11	42·26
Water	53·39	31·39
Ash	4·46	6·34
Loss	0·56	4·88
	100·00	100·00

A substance named *Than*, used to adulterate kutch in Burma, was investigated by Dr. Romanis in 1888. Than is a red-coloured gum or mixture of gums, insoluble in spirit, and having no action on polarized light. Under some circumstances it ferments and evolves gases. It contains no leather forming property, but is thrown down by gelatine and alum; if, however, this precipitate is boiled in water, the than is dissolved. (*Chem. Examiner's Report*, 1888.)

Commerce.—Gambier is imported into India from Singapore in large baskets. The exports of Kutch and Gambier from India are more than 300,000 cwts. annually.

Value, Rs. 4 to Rs. 6 per Surat maund of 37½ lbs.

CINCHONA SUCCIRUBRA, *Pavon.*

Fig.—*Howard's Illustrations, Neuva Quinologia. p.* 7. Red bark.

Hab.—Slopes of Chimborazo, S. America. Cultivated in Southern India, Sikkim and Ceylon.

CINCHONA OFFICINALIS, *Hooker.*

Fig.—*Bot. Mag.* 5364. The Loxa, Crown, Condaminea or pale bark of commerce.

Hab.—Ecuador and Peru. Cultivated on the Nilgiri Hills.

C. CALISAYA (*Wedd.*) and var. LEDGERIANA.

Fig.—*Howard's Quinology, pp.* 4, 5, 6. The Calisaya, Ledger, or yellow bark of commerce.

Hab.—Bolivia and Southern Peru. Cultivated in Sikkim and Southern India.

History, Uses, &c.—Cinchona bark was introduced into Europe in the 17th century, when it was brought over by Jesuit missionaries from America. The Countess of Chinchon, the wife of a Viceroy of the Spanish colony of Peru,

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had been cured of an attack of fever by its use, hence the early names of the medicine were *Peruvian or Jesuit's bark* and *Countess's powder*. The trees yielding this bark were not discovered until a century later, when La Condamine and Jussieu, members of a French exploring party, obtained some plants. Linnæus established the botanical genus Cinchona in 1742. Peruvian bark was acknowledged as a most valuable medicine soon after its introduction into Europe, and the consumption rapidly increased, but no care was spent over the preservation of the natural forests in South America. It would appear that the Jesuits in Peru about 1650 began to distribute the bark to those of their fraternity stationed in other parts of the world, as was their usual practice upon the discovery of any new article of economic value. In this manner it probably reached India not long after its discovery in America.

After its admission in 1677 to the London *Pharmacopœia*, it was necessarily sent out to the physicians of the English East India Company. Its use must have spread rapidly, as in 1770 we find a description of it under the English name of bark (بورک) in the *Makhzan-el-Adwiya* of Mir Muhammad Husain, showing that it was already well known to the native physicians. He describes it as a bark resembling Cassia bark but of a darker colour, and remarks that its medicinal properties are said to have been discovered in Peru by a sect of Christians called Jesuits, who first brought it to Europe, and for this reason it bears the name of Jesuit's bark. It is also called Kina Kina. He correctly describes its use as an antiperiodic, and pronounces it to be hot and dry in the second degree. Quinine appears to have been first used in India in 1826; the records of the Government Medical Store Department show that the Government of Bombay purchased for trial in that year a small quantity of the new medicine at the rate of £28-10-8 per lb. from Mr. Sprague, a chemist and druggist, who had recently opened a shop in Bombay.

The demands for Cinchona and Quinine from India soon became so large that Dr. Royle, botanist to the Indian

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Government, fearing that the supply might cease, or be obtainable at a price beyond the reach of the community, recommended to Government in 1839, and again in 1852, that the cultivation of Cinchona should be tried in the country. No steps were taken in the matter until Mr. C. R. Markham in 1860 was selected to organize an expedition to the forests of the Andes for the purpose of collecting seeds and plants. Mr. Markham, accompanied by Mr. Weir, a practical gardener, undertook to collect seeds of the Calisaya or yellow bark tree in the forests of Bolivia and Southern Peru. Mr. Pritchett was to explore the Grey bark region of Huanuco and Humalies in Central Peru, and Messrs. Spruce and R. Cross were to collect the seeds of the Red bark trees in the mountains of Ecuador. Mr. Markham succeeded in collecting several hundred plants of Calisaya, but these were lost owing to the treatment they received *en route* to India. The other collectors were successful in their undertakings, not however without some hardships and disappointments, and the first seed of the Grey barks arrived in India in January 1861, and those of the Red barks a few months later. Mr. Cross was subsequently commissioned to procure seeds of the *C. officinalis* in the forests near Loxa, and this commission he executed with so much success that the seeds were brought to India in 1862. The seeds and young plants on their arrival were committed to the care of Mr. W. G. McIvor, Superintendent of the Botanic Gardens, Ootacamund, and it was to his patience and skill that the cultivation of Cinchona in India became an accomplished fact. Cinchona cultivation was introduced about the same time in the Bengal Presidency under the direction of Dr. T. Anderson. The first seeds sent to the Sikkim Plantations were from Kew; these were soon followed by plants of Pahudiana, Calisaya and Lancifolia from Java, and some Succirubras from Ootacamund. The Cinchona was introduced in Ceylon in 1861 by Dr. Thwaites, and was subsequently taken up with much vigour by the planters of that island. Plantations were opened up afterwards in Wynaad, Mysore, Coorg, Travancore and Tinnevelly entirely as private specula-

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tions. For further information the reader is referred to "*Peruvian Bark*," by C. R. Markham; "*Cinchona Barks Pharmacognostically considered*," by F. A. Flückiger; Blue Books. *Copy of Correspondence relating to the Introduction of the Cinchona Plant into India, &c., with Maps.* 1852 to 1875, 5 volumes; *The Annual Reports on the Government Cinchona Plantations, Bengal and Madras*, up to 1889.

Small doses of cinchona preparations and quinine augment the force of the heart's constriction, increase the appetite, and act as a general tonic, but if too frequently repeated, the contractile power of the heart is diminished, although the rate of its movements progressively increases; the latter effect is also produced by large single doses. Poisonous doses annihilate the heart's contractility, producing rapid death; yet if the operation is not promptly fatal, the respiratory movements cease before those of the heart. Theoretically, in moderate doses, quinine stimulates the trophic centres, and quickens tissue change, but in large doses it has the opposite effect. The reduction of the pulse rate and force by quinine is attended by a reduction in temperature. Observations of the effect of quinine upon the blood corpuscles have led to no very satisfactory conclusions. When 5 or 6 grains of sulphate of quinine are taken by an adult man at a single dose, or two or three times that quantity in the course of 12 hours, there is apt to be some heaviness and confusion of thought, headache, buzzing in the ears, vertigo, and unsteadiness of gait. Larger doses occasion, in addition, a sense of fulness, tension, and pulsation in the head; the face becomes suffused and animated; the eyes are bright; epistaxis sometimes occurs; the patient is restless and agitated, and complains of muscular twitching in the limbs. After several hours these phenomena are followed by some degree of exhaustion and a disposition to sleep, with slight torpor and muscular debility. If as much as 30 grains are given daily for several days, in divided doses, there may be observed great depression, apathy, somnolence, unsteadiness of gait, impaired sight and hearing, and dilatation of the pupils; the general

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sensibility is obtuse and the limbs tremulous. If, finally, the dose has been excessive, complete loss of consciousness may occur, the sight and hearing fail, the skin loses its sensibility, and the limbs their power of motion.

The usual and most probable interpretation of these phenomena is that quinine in moderate doses primarily stimulates the nervous centres and increases the amount of blood circulating in them; that in excessive doses it diminishes the supply of blood to the same parts; and that this diminution results mainly from the depressed power of the heart. The most important fact in support of this view is that the giddiness, confusion of sight, and faintness caused by quinine subside as soon as the patient lies down.

On the *respiratory organs* the primary action of quinine is stimulant, slightly increasing the rate of breathing. Poisonous doses occasion dyspnœa and noisy respiration, which is also jerking, interrupted, retarded, and finally arrested, death taking place with symptoms of asphyxia. In some cases the sputa have been bloody. Doubtless the latter phenomena are due to a paralyzing influence exerted by quinine upon the respiratory nervous centres, coupled with an analogous action of the drug upon the cardiac nerves and ganglia. According to certain experiments upon rabbits (*Strassburg*), quinine does not diminish the exhalation of carbonic acid, even while it lowers the temperature.

On the *digestive organs* small doses of quinine, as of all pure bitters, stimulate the appetite and digestion, but in large and continued doses it irritates the stomach and confines the bowels at first, although it may afterward cause diarrhœa.

The fact that when quinine cures intermittent fever it also contracts the *spleen*, if that organ is enlarged, is a familiar one. It is also known that when quinine is largely administered to animals for various experimental purposes the spleen is found pale and hard and its capsule wrinkled. These effects occur even when all the nervous trunks supplying the organ are divided. Hence, it is concluded that quinine must act upon the internal nervous system of the spleen. (*Binz.*) The function of the organ, it is added, being to form the white corpuscles of the blood and to prepare various oxidized substances, and especially uric acid, for excretion, and quinine having the power of restraining both of these operations, necessarily the organ appropriated to them must contract in proportion to the restriction of its functions.

Quinine, being excreted with the *urine* to the extent of at least one-half, sometimes occasions irritation of the urinary passages, causing in different cases micturition, retention of urine, and even hæmaturia. (*Stillé and Maisch.*)

But the most important property of quinine is its destructive action upon the low animal organisms (hæmatozoa), whose presence in the blood has been shown by Laveran (*Archives de Médecine Expèrimentale*, 1., p. 789; ii., p. 1,) to be the exciting cause of malarial fevers. Previous to Laveran's great discovery, the power possessed by the cinchona alkaloids of preventing as well as curing these fevers had long been a well recognised fact, and it was known that a person under the influence of a dose of quinine (2 to 5 grains given once or twice a day) might be exposed to malarial contagion without danger. The antiseptic properties of quinine had also been sufficiently established, a dilute solution having been found to preserve fluids containing animal matter from putrefaction for a length of time, although it had not the same destructive action upon the lower forms of algæ as it had upon the lower forms of animal life. Laveran's observations, which have now been amply confirmed, show that the hæmatozoa of malaria are present in the blood in the greatest number immediately before the febrile paroxysm, which is an effort of nature for their destruction, and that the administration of the cinchona alkaloids, and more especially of quinine, has a marked effect in reducing the number of these parasites, and inasmuch as they remove the cause of the irritation, they also prevent the recurrence of the febrile paroxysms. (*Op. cit.* 1889—90; *Laveran, Traité des fièvrês palustres, Paris*, 1884.)

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Quinine has no power to originate uterine contractions in the pregnant female, but when once parturition has commenced, the flagging pains are greatly stimulated and increased by a dose of ten grains of the drug, and when abortion is threatened through malarial influence, no hesitation should be felt in using it. Quinine should always be given in some easily soluble form, as any salt of the alkaloid which escapes absorption in the stomach must be precipitated by the alkaline juices of the bowels, and be absorbed very slowly or not at all. Dr. G. Kerner has found it in the fæces partly in an amorphous form and partly as a crystalline bitter fluorescent substance, named *dihydroxyl-quinine ;* the alkaloid has also been found in the tears, sweat, milk, urine and saliva.

In malarial fevers quinine should be administered in such a way that the last dose should be ingested about 2 hours before the expected return of the paroxysm, and the first dose 4 or 5 hours previous to the last. When there is sufficient time, its influence is almost always very sensibly aided by the exhibition, 12 or more hours before, of a mercurial or other purge. In typhus and typhoid fever, scarlatina, severe erysipelas, rheumatic hyperexia, &c., after the use of the cold bath, 20 grains are often very efficacious in preventing a rapid return of the excessive fever. (*U. S. Dispensatory*, 1889.)

In the year 1866, the Madras Government appointed a Medical Commission to test the respective effiacy in the treatment of fever of quinine, quinidine, cinchonine and cinchonidine. From the Report it appears that the number of cases of paroxysmal malarious fevers treated was 2,472,—namely, 846 with quinine, 664 with quinidine, 559 with cinchonine and 403 with cinchonidine. Of these 2,472 cases, 2,445 were cured and 27 failed. The difference in remedial value of the four alkaloids as deduced from these experiments may be thus stated :—

Quinidine	—ratio of failure per 1000	6
Quinine	,, ,, ,, ...	7
Cinchonidine	,, ,, ,, ...	10
Cinchonine	,, ,, ,, ...	23

In 1880 a further report was made on some trials of cinchona febrifuge in quotidian, tertian, quartan and febricula. Out of 5,081 cases, 92·2 per cent. were cured. The administration of febribuge is often attended with nausea, which was supposed to be due to the amorphous alkaloid present, which is more readily absorbed in the system than the crystalline alkaloids. Purified amorphous alkaloid in small doses of two grains is very active, and has been found in Holland and in Madras to have distinct antiperiodic properties.

The Cinchona Plantations and Harvesting the Bark.—There are three Government Cinchona estates on the Nilgiris, situated at Ootacamund, Naduvatam, and Pykara. Each estate consists of one or more plantations; Naduvatam comprises Denison, Kilgraston and Napier; Pykara is composed of Hooker and Wood; and Dodabetta represents the whole of the minor plantations known under that name. The site occupied by Dodabetta is the ravine behind the Botanic Gardens, situated at an elevation of from 6,500 to 8,000 feet above sea-level, and with a mean temperature in the shade of 60° and a maximum of 70°. During the months of December, January and February the frosts are often severe, and considerable damage is done to the trees lying in the lower parts of the estate. This estate is named after the mountain, about two miles off, called Dodabetta, from Dodda (great) and Betta (hill), which is 8,642 feet above the sea, consequently the highest point on the Nilgiris, and one of the highest in Southern India. The Naduvatam estate is situated about 22 miles from Ootacamund, at the top of the Gudalur ghaut, and on the verge of the steep descent to the Wynaad plateau. The elevation varies from 5,000 to 6,000 feet, with a mean temperature of 60° in the shade, and maximum of 80° and a minimum of 54°, and an average rainfall of 105 inches. The trees grown here are Succirubras and hybrids, and several experimental plots of Calisayas, Carthagena, Santa Fé and Remijias. The Pykara estates are made up of Hooker and Wood plantations separated by the Pykara river. The elevation ranges from 5,000 to 6,200. It is estimated that the area

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covered by all these estates is 1,779 acres, the greater portion of which is under cultivation. The total number of trees in 1889 were reckoned at 1,709,656, and included the following varieties:—

Officinalis	981,919
Hybrids	655,856
Succirubras	70,693
Calisayas	273
Other kinds	915
	1,709,656

In 1879, ten years previously, the number of plants on the estates was computed at 569,031, and was composed of the following:—

Officinalis	305,432
Succirubras	260,837
Grey	1,874
Calisayas	552
Other species	336
	569,031

The *Cinchona officinalis,* yielding the Crown bark of commerce, is the chief species cultivated on the Nilgiris, and is one of the most desirable kinds for the manufacture of quinine. The Calisaya bark is the best quinine yielder of all the cinchonas, but unfortunately will not grow on the elevated sites of the Government plantations. *Cinchona succirubra* affords a bark, official in the British *Pharmacopœia,* and which obtains but little favour now in commerce. The statistics of 1879 compared with 1889 show how the red and grey bark plants have given way in the plantations to species of much greater value, such as the officinalis and the officinalis hybrid.

The outturn of bark from these estates is calculated at 100,000 pounds per annum, the whole of which has until recently been sold in London, or by public auction in the country, but within the last two years the manufacture of sulphate of quinine and other alkaloids has commenced, and to such an extent as to consume all the bark likely to be produced on these plantations in the future.

Besides those of Government, there are several private estates on the Nilgiris, among which might be mentioned Ossington, Devashola, Liddellsdale, and other estates at Coonoor and Kotagiri. Cinchona is largely planted in Wynaad, where an estimate of 5,000,000 plants has been reported. The species mostly cultivated are *Cinchona Ledgeriana* and *C. succirubra*, and a hybrid between these two kinds, which gives a very valuable bark containing as much as 8 per cent. of sulphate of quinine. Travancore afforded suitable sites for cinchona, and extensive tracts were planted up with Red and Crown bark varieties in the Peermaad hills and mountain districts about Devakolam, but the small remuneration accruing to the planter has caused cinchona to be neglected, and tea, as a more promising plant, is being reared in its stead.

The Darjeeling plantations of the Bengal Government are situated some 17 miles from the station of that name in the valley of the Ryang, and at Sittong in the valley of the Teesta, British Sikkim. They were commenced in the year 1862 at Rungbee, and the head-quarter buildings and factories are at Mongpoo. Some land has been opened out at Runjung in British Bhutan, but the plants have not shown so much promise as those at Sikkim, on account of the heavy rainfall in that district. The Sikkim plantations are at an elevation of from 1,400 to 5,000 feet, and occupy a tract of about 20,000 acres, only a part of which is cultivated. The Ledger cinchonas are here reared to a very large extent. Succirubra and its hybrid also grow well, and the Morada and Verde types of Calisaya have within the past few years been put out with very encouraging results. Ledgers thrive best at this latitude between 2,000 to 3,500 feet, while the Moradas and Verdes prefer a somewhat lower elevation. It has been noticed that Ledgers like a sunny aspect and Succirubras a northerly or shaded one. The plantations never reach an old age, for when the trees are 6 or 8 years old, they are cut down and uprooted, and the whole of the bark is scraped off. The plot of land is then left for a

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few years, after which it will be ready for planting up again. These plantations, therefore, possess almost unlimited tracts of the richest soil in which to extend the cultivation. The bark harvested in Sikkim differs from that of the Nilgiris in being all of one kind—namely, natural, and it is estimated that as much as 300,000 pounds can be harvested each year. In 1862 there were 311 plants. In 1875 there were 2,000 acres planted up with 3,000,000 trees from 4 to 30 feet high. At the end of the financial year 1882, there were 4,731,608 plants of the following kinds:—

Succirubras	3,873,285
Calisayas	566,695
Hybrids	291,628
	4,731,608

At this time the Darjeeling plantations were using the Succirubra bark for the manufacture of febrifuge. Recently a method has been discovered for making sulphate of quinine, hence the plantations have been adapted for the production of a larger yield of richer bark, and the statistics of the number of trees in 1889 show how this object has been attained:—

Succirubras	1,882,000
Calisayas	1,768,060
Hybrids	1,145,170
Other species	15,001
	4,810,231

The number of Succirubras has been reduced by one-half, the Calisayas have been trebled, and the hybrids quadrupled, and in this manner the alkaloid-yielding plants are being gradually replaced by those affording pure quinine.

The area of private plantations is—

Bengal	1,355 acres
Madras	6,444 ,,
Coorg and Mysore	2,000 ,,

There are four methods of collecting or harvesting the bark:—

1, By taking it in longitudinal strips from the standing tree,

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and leaving the bark to renew over the exposed wood; 2, by scraping and shaving off the bark; 3, by coppicing; and 4, by uprooting. The first is that most in use in, and peculiar to the Nilgiris, having been discovered by Mr. McIvor. The trees are barked preferably in the rainy season, when the bark "lifts," or is more easily removed from the wood. The coolie inserts the point of a knife in the tree as far as he can reach and draws it down, making an incision in the bark straight to the ground; he then makes another cut parallel to the first, about an inch and a half apart, and loosening the bark with the back part of the knife, the strip or ribbon is taken off. If the operation is performed carefully, and the cambium cells are not broken, a new layer of bark will be formed in the place of that which is taken away. Other strips are taken at intervals around the stem, and the tree is then covered by moss, grass or leaves of *Phormium tenax*, and bound on by coir string or fibre. The stem is covered after the operation of stripping in order to foster the growth of the new bark (renewed bark) from the cambium, and to thicken the untouched layers of natural bark, which are now termed mossed bark. The moss which was first used to cover the partly decorticated stem is not now used on account of its scarcity, and grass, straw, leaves, tin and newspapers have been found to answer the purpose. After about two years, the trees are again visited, and if recuperation has gone on satisfactorily, the mossed bark is harvested in strips, leaving the renewed bark to thicken, and to allow a further supply of renewed bark to take the place of the mossed. The renewed bark is always of greater value than the mossed and the mossed than the natural, so long as the trees are under 20 years old, for it has been found that after that time the bark ceases to thicken, and the alkaloids remain stationary or even decrease. The bark being collected in wet weather artificial heat has to be used in drying it. Both at Naduvatam and Dodabetta there are abandoned jails where the bark is dried; fires are lighted beneath, and flues conduct the heat through the building where the bark is laid on a series of shelves. Sun heat is used at lower elevations, where other kinds of Cinchona

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are grown, and where the expense of artificial heat could not be met. The shaving process was first practised in Java, and consists in shaving off the superficial layers of bark from the whole surface of the stem, taking care that no point of the wood is laid bare. Coppicing Cinchona is to cut the tree down to a foot above ground, and to allow one or more shoots to spring up from the stool. Uprooting is adopted in the Bengal plantations, where the trees are uprooted and the whole of the bark is collected from the root, trunk and branches.

Description.—Cinchona bark is usually exported in packages, which are subjected to hydraulic pressure and arrive in the market more or less in a comminuted condition. Crown bark occurs in single quills with a blackish surface, often covered with various lichens (*Usnea, &c.*); it breaks with a fibrous fracture, and the powder of the bark is light brown. Succirubra bark is rough and warty on the outer surface, with fewer cryptogamic plants, and thicker than other kinds. It has a fibrous and splintery fracture, a reddish inner surface, and yields a reddish brown powder. Ledger bark is generally uncoated yellowish brown or whitish with black markings; the epiphlœum often falls off in flakes; the inner substance of the bark is yellowish brown, which is the colour of the powder. Root bark from all kinds of Cinchona is in the form of short recurved or twisted pieces, thicker and lighter in colour than the stem bark. Shavings consist of the outer or cellular portion of the bark, and are consequently thin and brittle, and are easily crushed in packing. Mossed bark has a dark surface, is usually free from lichen, and occurs in thick, half or single quills. Renewed bark is light in colour, easily fractured on account of the absence of much liber, and is known by the peculiar uniform smoothness of its external surface. The characters of Cinchona bark can best be studied in carefully prepared and exported samples of what is known in the market as "Druggist's bark." The character of the drug supplied to the manufacturers is of less importance than a knowledge of the amount of quinine it contains which is determined solely by chemical analysis. Indian Cinchona bark has never been

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known to be adulterated with any of the bitter indigenous drugs of the country.

Chemical composition.—The constituents of Cinchona bark of most importance are the bitter alkaloids or bases, to the first in the following list of these principles, the value of the drug almost exclusively depends.

Quinine, $C^{20}H^{24}N^2O^2$, is a light-coloured, amorphous, brittle substance in an anhydrous state, but may be obtained in a crystalline condition with $3H^2O$. It is soluble in ether, alcohol, chloroform, and very slightly in water. Aqueous solutions of the salts made with the oxygenated acids possess a blue fluorescence, and when treated with chlorine water and ammonia, a beautiful green solution is produced, known as the thalleioquin test. The solutions deviate the plane of polarization to the left. The quinine salt mostly used in medicine is the sulphate $(C^{20}H^{24}N^2O^2)^2$, $H^2SO^4,7H^2O$, the theoretical centesimal composition of which is—

Quinine	74·31
Sulphuric acid	11·23
Water of crystallization	14·45

Cinchonidine, $C^{19}H^{22}N^2O$, forms colourless anhydrous crystals. The sulphate is more soluble in water than quinine, and the tartrate is very insoluble. The solutions show the same optical behaviour as quinine but to a less extent.

Quinidine possesses the same formula as quinine, and the solutions of its salts are fluorescent and afford the thalleioquin reaction; it differs, however, in deviating the plane of polarization to the right. It is separated from the other alkaloids as an insoluble hydriodate.

Cinchonine is not very soluble in ether and alcohol. The formula is the same as that of cinchonidine, but has exactly the opposite action upon polarized light.

Amorphous alkaloids, called also *Quinoidine* or *Chinioidin*, occur in all Cinchona barks and leaves. It is the name given to the preparation obtained in quinine factories, and in analysis by precipitating the mother liquors with alkali. It is a dark

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brown brittle mass softening below 100° and alkaline in reaction.

Quinamine, an unimportant alkaloid, was discovered in 1872 by Hesse in Succirubra bark cultivated at Darjeeling. Other Cinchona bases have been found and described, but as they do not occur in Indian grown barks, they need only be mentioned by name. *Paricine* in *Buena hexandra*; *Aricine and Cusconine* in false Cinchona of undetermined origin. *Pitoyine* in China bicolorata Tecamez; *Paytine* in white bark; and *Homoquinine* discovered by D. Howard and others in Cuprea bark from *Remijia* species in 1882.

The above bases are combined with Kinic and Cincho-tannic acids. *Kinic acid*, $C^7H^{12}O^6$, occurs in monoclinic prisms soluble in water and alcohol, but hardly in ether. The solutions are levorotatory. By heating it with peroxide of manganese and sulphuric acid, yellow crystals of quinone ($C^6H^4O^2$) are produced.

Cincho-tannic acid, the astringent principle of the Cinchonas, is soluble in water and spirit, and is precipitated by acids, acetate of lead and gelatine. It strikes a green colour with ferric chloride, and affords pyrocatechin by destructive distillation. Its solution in the presence of an alkali, or by boiling with dilute sulphuric acid, decomposes into an oxidized product, *Cinchona-red*, and a sugar. *Cinchona-red* occurs naturally in red bark as an amorphous substance soluble in alkaline solutions and alcohol, but neither in water nor in ether.

Quinovic acid crystallizes in scales, which are sparingly soluble in cold alcohol, more readily in hot alcohol, but insoluble in water, ether, or chloroform.

Quinovin, an amorphous bitter substance present in nearly every part of the plant, is resolvable into quinovic acid and *mannitan*. It is removed from the bark by diluted soda, from which it is precipitated with cinchona-red by an acid, from this, milk of lime dissolves out quinovin and quinovic acid, which are again precipitated by an acid, and separated by chloroform, in which the former is very soluble.

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The wax-like principle of barks has been designated by Kerner *cinchocerotin*. Hesse has found two substances of this nature; *cupreol*, $C^{20}H^{34}O$, melting at 140°C, and *cinchol* melting at 139°; they both crystallize in laminæ, but differ in optical properties.

Cultivated barks yield over 3 per cent. of mineral matter; the average of three hundred estimations was 3·42 per cent. Renewed and old natural barks are poor in ash, but scarcely, if ever, fall below 2 per cent., while young and branch barks give 4 per cent. or more. Crown bark is richer in ash than that of the red, and the red than that of the yellow. From a complete analysis of the ash of Officinalis bark, it appears that lime forms one-third and potash one-sixth of the whole, and in that of Succirubra bark, lime forms one-third and potash one-eighth of the whole. A full grown Succirubra tree has been analysed and found to contain nearly half a pound of pure lime (CaO).

Effects of Cultivation on the Alkaloids.—The alkaloids first appearing in young plants and in leaves and twigs are in an amorphous state, but as growth proceeds they become crystalline, hence it is probable that the latter are produced from the former. In diseased and dead bark and in that killed by frost, the alkaloids revert to an amorphous condition, and gradually disappear.

Trees of the same species and height, and growing under exactly similar conditions of aspect and soil, are not necessarily of the same alkaloidal value. They vary in amount of total alkaloids, but the proportion of quinine in the total alkaloids remains fairly constant for each species. This proportion averages 70 to 80 per cent. in Ledgers, 60 to 70 per cent. in Officinalis, and 20 per cent. in Succirubras. Hybridization between these plants materially affects these proportions according to the parents of the hybrid. Succirubra has influenced the Officinalis of the Nilgiris and the Ledgers of the Wynaad, forming characteristic hybrids, with their alkaloids to a very large extent taking up a mean between those of the parents. Several analysis of the Officinalis hybrid show that the alkaloids contain 41 per cent. of quinine in the total alkaloids, and the Ledger hybrid 58 per cent.

Ledgers and Succirubras do not much increase in alkaloidal value after 6 years of age, and therefore should not be barked when young. The Officinalis, being of slower growth, does not mature or yield the full amount of alkaloid, until the trees are at least 7 years old. The faster-growing trees appear to begin to degenerate after 15 years, and the Officinalis after 20 years.

The north or shaded side of a tree has a richer bark than that on the south side—a fact which explains the success of the mossing-system, where the bark is entirely protected from the light and heat of the sun's rays, and a larger yield of alkaloids thereby encouraged. The renewal of most barks under moss, or a similar covering, has a tendency to increase the amount of quinine at the expense of the cinchonidine, except in the case of Calisaya bark, where there is very little cinchonidine naturally existing. In the renewal of grey barks (*C. micrantha*, &c.), where no quinine or cinchonidine are found in natural bark, cinchonidine is formed at the expense of the cinchonine, which is always present in these barks in large quantity.

A large number of experiments have been made in manuring Cinchonas, and all the more important trees have been operated upon at different ages and during short and long periods. In every case the manures have increased the amount of alkaloids in the bark, and, as a rule, the increase has been in the most valuable alkaloid quinine. Manure affects the bark of young trees more quickly than that of older ones; but, on the other hand, old trees of twelve years and upwards are greatly improved by manure when it is allowed a longer time to work, about two years or more.

Some analyses of frost-bitten barks show that there is very little diminution in alkaloids when compared with natural bark analysed before the frost. It was formerly supposed that frost-bitten barks were worthless.

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The object in the Indian plantations has been to propagate those species known by analysis to contain much quinine, or if these will not grow, to raise robust trees which will yield more quinine by cultivation. Hybrids are on the increase in many estates, and by careful selection from these, the value of the future cultivation will largely depend.

The following table gives a list of the most important barks grown on the Government plantations at the present time, with a full analysis of each :—

	Quinine.	Cinchonidine.	Quinidine.	Cinchonine.	Amorphous Alkaloids.	Total.	Sulphate of Quinine.
C. officinalis, natural	2·93	1·40	·08	·42	·42	5·25	3·94
,, mossed	3·40	1·50	·20	·45	·62	6·17	4·57
,, renewed	4·21	·85	·22	·65	·70	6·63	5·66
C. succirubra, branch	1·38	2·28	...	1·59	1·16	6·41	1·85
,, natural	1·40	2·25	...	1·92	·68	6·25	1·88
,, mossed	1·69	2·03	...	1·68	·98	6·38	2·27
,, renewed	1·84	1·48	...	1·25	·71	5·28	2·47
,, ,, shavings.	2·30	1·16	...	2·06	1·45	6·97	3·09
C. angustifolia, natural......	3·97	1·32	·12	·12	·87	6·40	5·34
,, mossed......	5·60	1·41	·33	·04	·97	8·35	7·53
,, renewed ...	4·91	·89	·38	·19	1·14	7·51	6·60
C. hybrid, branch	1·64	2·71	...	1·17	·50	6·02	2·20
,, natural	3·19	2·87	...	·67	·55	7·28	4·29
,, mossed	1·92	3·16	...	·77	·35	6·20	2·58
,, renewed	4·40	2·54	...	·51	1·65	9·10	5·92
C. micrantha, branch	...	...	...	1·60	·45	2·05	...
,, natural	...	...	...	1·92	·40	2·32	...
,, renewed......	tr.	2·45	...	1·12	1·02	4·59	tr.
C. pitayensis, natural	2·34	·56	1·10	1·93	·39	6·32	3·14
,, mossed	3·81	·95	·63	1·91	·37	7·67	5·12
,, renewed	2·50	·52	·78	2·33	·55	6·68	3·36
C. Calisaya, natural	1·21	2·32	...	2·13	·29	5·95	1·62
,, branch	·59	·73	...	1·93	·48	3·73	·79
C. Anglica, natural	·81	·88	·29	1·49	·44	3·91	1·09
,, branch	tr.	tr.	·25	2·04	·36	2·65	tr.
C. Javanica, natural	...	...	1·32	2·64	·48	4·44	...
,, branch	...	...	1·43	1·49	·45	3·37	...
C. Ledgeriana, natural......	5·49	1·33	...	·82	88	8·52	7·38
,, branch	2·21	·49	...	1·07	·50	4·27	2·97
C. Humboldtiana	2·24	1·55	tr.	·49	·90	5·18	3·01
C. nitida	1·42	2·45	...	1·45	·67	5·99	1·91
C. Pahudiana	·04	·10	...	·39	·43	·96	·05
C. Carthagena	...	·40	...	1·64	1·51	3·55	...
C. Santa Fé......................	1·71	·83	...	·60	·66	3·80	2·30
C. Succirubra, Sikkim	·66	1·12	...	1·93	·77	4·48	·88
C. Ledgeriana ,, ...	2·92	·38	·11	·14	·21	3·66	3·93
C. hybrid ,, ...	2·24	2·13	...	·69	·54	5·60	3·01

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Manufacture of Alkaloids and Quinine.—The authorities in charge of the Cinchona plantations have for many years seen the desirability of extracting in the country the alkaloids so valuable in fevers and in a form that could readily be taken.

At the suggestion of Dr J. E. de Vrij, the manufacture of a light-coloured powder, consisting of the alkaloids of red bark, was started in 1874. This powder was called "quinetum" or "febrifuge," or, with reference to the locality of its production, Sikkim or Darjeeling febrifuge. Febrifuge is made by exhausting the powdered red bark with water acidulated with hydrochloric acid, precipitating the liquor with caustic soda, and drying the crude deposit. This is again dissolved in sufficient acid, reprecipitated by soda in a pure condition, filtered, dried and powdered. It has a tolerably uniform composition of Quinine 15·5; Cinchonidine 29·0; Cinchonine 33·5; Amorphous alkaloids 17·0; and colouring matter, &c., 5·0 per cent.

About three years ago, Mr. J. A. Gammie, the resident Superintendent, with the co-operation of Mr. C. H. Wood, formerly Quinologist to the Bengal Government, elaborated a method of extracting quinine from yellow bark, called the "oil process." It is called the oil process, because a mixture of fusel and kerosene oils is employed in the manufacture. The finely-powdered bark is mixed with water containing caustic soda in solution, the oils are added, and the whole is intimately agitated for a few hours and then allowed to rest. The alkaloids are then contained in the oil, which is decanted, and stirred up with water acidulated with sulphuric acid. The acid liquor now containing the alkaloids is transferred to pans and heated by steam; while still hot, the liquor is neutralized with soda and filtered, and on cooling, the solution yields the crystals of sulphate of quinine. The crude crystals are purified by dissolving them in a certain amount of hot water, filtering and cooling, and the crystals which form are collected and dried in a warm air-chamber.

Commerce.—Indian Cinchona bark began to be exported in 1867; the first three bales realized Rs. 287, and sold in London for 2 shillings per lb. From 1871 to 1886, when the export ceased,

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the Madras Government plantations sent bark to England to the extent of 31 lakhs. Red barks first sold for 2*s*. per pound and Crown barks for 3*s*. The total export from India from October 1 to September 31 was:—

1886-87......	1,286,900	lbs.
1887-88......	1,449,315	„
1888-89......	3,074,098	„

Cinchona bark is sold by the unit of sulphate of quinine. The unit is the price in pence per pound of bark containing one per cent. of sulphate of quinine. In 1885 the price of bark reached 7*d*. per unit; at the present time, 1890, it is not more than 2*d*. In 1885, a bark containing 3 per cent. of sulphate would have been worth 1*s*. 9*d*. per pound; at the present time the same bark would not sell for more than 6*d*. The fall in the price of bark has had the effect of lowering the price of the alkaloids; sulphate of quinine, for instance, last year sold for 1*s*. per ounce. The price had been gradually declining from 1877, when it was valued at 16*s*. 6*d*. per ounce in bulk.

HYMENODICTYON EXCELSUM, *Wall.*

Fig.—*Wight Ic.*, *t.* 79.

Hab.—W. Himalaya, Deccan, Central India, Tenasserim, Chittagong. The bark.

Vernacular.—Bhaulan, Barthoa (*Hind.*), Bandárú (*Tel.*), Sagapu (*Tam.*), Kála-kadva, Bhoursál (*Mar.*).

History, Uses, &c.—Roxburgh states that the inner coat of the bark possesses the bitterness and astringency of Peruvian bark. *H. excelsum* is his *Cinchona excelsa*. Ainslie quotes Roxburgh, and tells us that the bark is used by tanners, and also as a medicine by the Hindus in cases requiring astringents. The tree yields a bitter bark in common use among the natives as a tonic and febrifuge, which was tried in the Calcutta Medical College Hospital by O'Shaughnessy, and found to be most valuable. In 1870, Broughton examined the fresh bark of one of the Hymenodictyons, and found that the bitter taste was due to the existence of *æsculin,* and that the bark when dry was almost tasteless owing to the transformation of that substance into *æsculetin,* the decomposition having been induced by contact with decaying organic matter. The fact here mentioned that the bark when dry lost its bitterness leads us to suppose that it was not that of *H. excelsum* but of *H. obovatum,* the dry bark of the former tree being extremely bitter.

Description.—The bark of *H. excelsum* is very bitter, and may be distinguished from that of *H. obovatum* by its red colour and bitterness. The minute structure resembles that of the Cinchonas, but the bundles of stone cells are larger, the spiral and laticiferous vessels also are more numerous, the latter being very large, and exuding when cut a waxy latex. Many of the cells are filled with a red-colouring matter as in Cinchona bark; and there is a continuous ring of stone cells near the junction of the bark with the wood. The bark examined was from branches about one inch in diameter.

Chemical composition.—From an examination of the bark made by W. A. H. Naylor in 1883, it appears that the bitter principle is not the glucoside æsculin, or its decomposition product, æsculetin, but an alkaloidal substance allied to quinoidine, berberine and paricine. From quinoidine it differs in being optically inactive, and from its double compound containing relatively less platinum. From berberine it differs in that it contains a higher percentage of carbon, while its double compound also yields a relatively larger amount of platinum. From paricine it differs only in the percentage of hydrogen it gives. Mr. Naylor considers it to be a new alkaloid having a composition corresponding to the empirical formula $C^{24}H^{40}N^{3}$, and therefore an addition to the small class of bases devoid of oxygen. Besides *Hymenodictyonine,* which is the name given to the new alkaloid, Mr. Naylor has separated a bitter neutral principle, represented by the formula $C^{22}H^{45}O^{10}$,

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which he thinks may possibly be a decomposition product of a glucoside.

In a paper read before the Pharmaceutical Society in 1886, Mr. Naylor gave the following account of further experiments made with the alkaloid hymenodictyonine:—

"On gradually adding a weak solution of iodine in ether to an ethereal solution of the alkaloid, the iodine became decolorized and a deep orange-red precipitate was formed, which quickly agglutinated and presented the appearance of a black resinous mass. By continuing the addition of iodine until it ceased to be decolorized an excess could readily be recognised. The resultant varnish-like mass was washed freely with ether, in which it was but little soluble, and then treated with hot alcohol. It was soluble to a considerable extent in cold alcohol, but its solubility increased with increase of temperature. It was hoped that by the use of a limited quantity of this solvent, acting on the compound at a suitable temperature to be ascertained by experiment, followed by a gradual process of cooling, a crystalline derivative would separate. The expectation was not realized, for the substance that separated under these conditions was always amorphous.

"The experiment was next tried of adding iodine in large excess to a solution of the alkaloid in much ether. This had the effect of producing a more flocculent precipitate at the moment of its formation, but toward the end of the reaction the several particles began to coalesce. This viscid mass was treated precisely as the previous one, and refused to be coaxed into crystallizing.

"A third attempt was made by precipitating a weak solution of the alkaloid in ether, with rather less iodine than would be required to produce complete precipitation. The precipitate was subjected to the same treatment as the previous ones, and resembled them in the granular appearances of their separations from alcohol, notwithstanding the inducement to assume some definite form offered by the varying temperatures to which they were subjected.

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"Although, after much labour and thought, I have failed to obtain an iodo-derivative in a crystalline form, I do not regard it as one of those organic principles to which the faculty of crystallization has been denied, but believe that a more perfect knowledge of the conditions of its formation in a state of purity would lead to its production. This belief is encouraged by a close correspondence to a possible formula which may be assigned to the iodo-compound prepared by the method last described. That portion of the viscid mass which dissolved in a limited quantity of hot alcohol and separated out on cooling, gave, in a series of iodine determinations by combustion with quick lime, the equivalent of 47·52 per cent. The formula $(C^{23}H^{40}N^{2})^{2}I^{5}2HI$ would require 47·92 per cent of iodine. Throughout these combustions it was observed that a fatty looking substance distilled over, having the characteristic odour of naphthaline. From solution in alcohol it crystallized in white scales.

Several attempts were made to produce a crystalline bromo-derivative, but without success. The flocculent precipitate which resulted from the reaction of ethereal solutions of bromine and alkaloid, after treatment with hot alcohol, gave on cooling a granular looking body, which was chiefly remarkable for the facility with which it parted with a portion of its bromine. A stable and definite compound was not obtained.

"The action of oxidizing agents on the alkaloid next claimed attention. The alkaloid was converted into sulphate, and to its aqueous solution was gradually added a one per cent. aqueous solution of potassium permanganate, until the liquid became permanently coloured. It was then concentrated by distillation to a small bulk and filtered. The filtrate was neutralized with sulphuric acid and evaporated to dryness. The residue was exhausted with hot alcohol, which on cooling gave a deposit and when quite cold was filtered. The filtrate was evaporated, taken up with water and converted into a silver salt, which was decomposed by sulphuretted hydrogen. Filtration, evaporation, and subsequent purification of the

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residue with alcohol and water, left a feebly coloured acid having the following properties:—

"It was markedly acid to litmus, and had a bitter after-taste. It dissolved readily in alcohol and water, and was but little soluble in ether. It united both with bases and acids. Its hydrochloride in aqueous solution when evaporated over sulphuric acid assumed an arborescent crystallization; the platino-chloride under the same conditions crystallized in plates or prisms. The acid was not precipitated with sulphate of copper, but gave with nitrate of silver a white gelatinous precipitate, which in the moist state became rapidly reduced on exposure. Lead acetate gave a white granular precipitate. Two determinations of the platinum in the platino-chloride dried at 115° C. gave 29·50 per cent. of platinum. The formula $(C^6 H^5 NO^2 HCl)\,{}^2Pt Cl^4$ requires 29·72 per cent. of platinum, and this is the platino-chloride of a pyridine-monocarboxylic acid, *viz.*, $C^5 H^4 N. COOH$. Further, the acid, or one of its salts, when distilled with lime, yielded as a product of decomposition a volatile base which possessed the peculiar odour and general properties of pyridine. This property of the acid, coupled with its behaviour towards reagents, and the percentage of platinum in its platino-chloride, may be accepted as trustworthy evidence of its being a carboxylic derivative of pyridine. If nitric acid be used in place of potassium permanganate the same acid is obtained.

It would therefore appear that in common with the rest of the non-oxygenated alkaloids hymenodictyonine is constitutionally related to pyridine.

OLDENLANDIA CORYMBOSA, *Linn.*

Fig.—*Rheede Hort. Mal. x.*, *t.* 35.

Hab.—Throughout India. The herb.

Vernacular.—Daman-pápra, Bakra, Pit-pápra (*Hind.*), Khet-pápara, Pit-pápara (*Beng.*), Khet-pápada, Pitpápada, Paripát (*Mar.*), Parpadagam (*Tam.*), Kallasabatra-sige (*Can.*), Verinella-vemu (*Tel.*), Khet-pápra (*Guz.*).

History, Uses, &c.—This plant, called in Sanskrit Kshetraparpata, or field *Parpata,* from its frequent occurrence in cultivated fields about the end of the rainy season, is the *Oldenlandia biflora* of Roxburgh and the *O. herbacea* of De Candolle. It is frequently mentioned in Sanskrit medicinal works, and is considered a cooling medicine of importance in the treatment of fevers supposed to be caused by deranged air and bile, that is, remittent fever with gastric irritability and nervous depression. The entire plant is prescribed in decoction, and is combined with aromatics as in the *Panchabhadra,* which is a decoction of Parpata, Mustaka, Gulancha, Chireta and ginger, of all equal parts, two tolas (360 grains) being given for a day's consumption.

Rheede, who calls it *Parpadagam,* notices its use in decoction with aromatics, for spasmodic fever, and also its application as an apozem with sandalwood and honey in the same disease. It must not be confounded with the Pitpápra of the Mahometans, which is Fumitory, and is distinguished in Sanskrit as *Yavanaparpata,* or Greek *Parpata,* or with the various substitutes for that drug which are in use in India under the name of Pittapapara.

Description.—An annual, slender herb, glabrous, rarely scaberulous, leaves linear or narrowly elliptic-lanceolate, margins often recurved, nerveless; peduncles solitary, 1 to 4 flowered, pedicel long, capillary, calyx-teeth subulate, rather shorter than the corolla-tube, crown of capsule low. It is a very variable plant, not always distinguishable from *O. diffusa* and *O. Heynii.* It varies from a diminutive straggling herb, with branches 1—2 in., to an erect one a foot and more high. Leaves from ½ to 2 by $\frac{1}{16}$ to ⅙ in., erect, spreading, or recurved, sometimes as broad as in narrow leaved forms of *O. crystallina;* stipules small, membranous, irregularly-cut, with a long and several shorter teeth or bristles. Capsule usually broad didymous, sometimes hemispheric or narrowed below the calyx-teeth, base acute or rounded, crown usually not rising above the base of the calyx-teeth, at others hemispheric and approaching that of *O. Heynii.* (*Fl. Br. India.*)

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Chemical composition.—A watery extract of this plant gave coloured precipitates with alkalies, a green reaction with ferric chloride, none with gelatine or acids, an abundant cream-coloured precipitate with lead acetate, and afforded indications of an alkaloid. A watery solution of an alcoholic extract had similar properties; it was mawkish and saline to the taste, and when evaporated to dryness it formed a mass of cubical, deliquescent crystals. A portion of this extract ignited left a saline residue consisting of potassium, sodium, and a small quantity of calcium, mostly existing as chlorides. No ammonia was detected in the herb, and the alkaloid was shaken out of an alkaline solution with ether, but had no very characteristic reactions. The value of the plant as a cooling medicine no doubt is due to the inorganic salts present. The dried herb left an unusually large incombustible residue, amounting to 22·2 per cent., very soluble in water.

Oldenlandia umbellata, *Linn., Roxb. Cor. Pl. t.* 3. Chayroot or Indian Madder.

Ainslie says:—"The small narrow, pale green leaves of this low growing plant the native doctors consider as expectorant, and prescribe them accordingly; of the virtues of the root in poisonous bites, colds and cutaneous disorders, as mentioned by Miller in his Dictionary, I know nothing. When dried and powdered the leaves are sometimes mixed with flour and made into cakes, which are eaten by such as suffer from consumptive or asthmatic affections. The dose of the decoction of the leaves is about an ounce twice daily." The root is long and slender, with a few lateral fibres, and of an orange colour. It is best known as a dyeing material. An account of its use for this purpose in India will be found in *Drury's Useful Plants of India,* 1873, pp. 240 and 470.

OPHIORRHIZA MUNGOS, *Linn.*

Fig.—*Gärt. Fruct. i., t.* 55.

Hab.—Mountains of Assam, Western Peninsula and Ceylon. The root and plant.

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Vernacular.—Kiri-purandán (*Tam.*), Sarpáshi-chettu (*Tel.*), Rásna, Nákuli (*Hind.*), Nanjáre, Rashme (*Can.*), Rásna, Mungusvel (*Mar.*), Mungusvel, Nákuli (*Guz.*).

History, Uses, &c.—This plant is described in Sanskrit in the following terms:—

> Nákuli, Surásá, Rásná, Sugandhá, Gandhanákuli,
> Nákuleshtá, Bhujangákshi, Chhatrica, Suvaha, Nava.

The fifth and sixth synonyms signify that its odour is agreeable to the Nákula, and the seventh that it is offensive to snakes.

It was first brought to the notice of Europeans by Garcia. Kæmpfer, who calls the root *Radix Mungo* (*Amœn.* 573 and 577), says of it:—"Radix est, plantæ Malaicé *Hampaddu Tanab*, id est, *Fel terræ* dicta, á sapore amarissimo omnium feré partium, præsertim radicis, quæ intensam bilis amaritiem exhibit, Lusitanis ibidem *Raiz* seu radix *Mungo* appellata, á mustela quadam seu viverra, Indis *Mungutia*, Lusitanis ibidem *Mungo*, Batavis *Muncus*. Garciæ ab Hort, (*Ar. Hist. L.i.*, c. 44.) *Quil* et *Quirpele* appellata, quæ radicem monstrasse, et usum ejus pro alexipharmico prima mortalibus prodidisse creditur. Est mustelæ huic is genius, ut serpentem naturali odio prosequatur; et velut glirem catus invadat. Tradunt igitur, si contingat morderi muncum, serpentis astutia roboreve victum, relicto hoste, pro alexipharmaco hanc radicem quærere, et esu ejus illico restitutum, certamen redintegrare. Sit fides rei penes indigenas. Hoc tantum de mustela hac exploratum habeo, morsam á vipera, vel luctu fatigatum, dimisso victore, ex palæstra in campum excurrere et obvias depascere herbarum radiculas, mox pastu, ut opinor refectam, rursus comparere ad certamen, cum hoste, si adsit, redauspicandum." Kæmpfer also says that the plant to his knowledge grows in Java, Ceylon, and Sumatra, is a foot or more in height, and not unlike the lesser Centaury. It has a single root, a span in length and as thick as the finger, much contorted, with a rough, brown, closely-adhering corky bark, and a hard, white fragile woody column; it has a bitter taste like Gentian but more delicate and agreeable. (*Op. cit.*, *p.* 577.) The supposed alexipharmic properties of this plant have long since been disproved, but it appears to be an agreeable bitter tonic.

Description.—A small shrubby plant, 1 to 1½ foot; stems hard and woody, bark light brown and corky; leaves opposite, elliptic-lanceolate, acuminated at both ends, glabrous, very thin, unequal in size, 2—5 by 1—2½ in., calyx-tube turbinate, limb 5-cleft; corolla-tube infundibuliform, short, hairy within, limb 5-lobed; stamens enclosed; capsule compressed, crowned with the calycine segments, 2-celled, 2-valved; seeds numerous, somewhat hexagonal; cymes peduncled, terminal, branched; flowers nearly sessile, white. The root consists of several hard, woody, contorted branches, about six inches in length, covered with a thin brown bark. The lower portions of the stem are generally collected along with the root, and to these Kæmpfer's description appears more particularly to apply, as the root-bark can hardly be described as corky. Taste moderately bitter.

Chemical composition.—A decoction of the root contained starch but no astringent matter. An alcoholic extract evaporated to dryness was a mixture of some green fatty oil containing chlorophyll, and a light brown resin which remained as yellowish red flakes when water was added. The resin was tasteless, and gave a blood-red colour with caustic soda and red with sulphuric acid; it dissolved in chloroform and other volatile solvents, but showed no disposition to crystallize on gentle evaporation of these solutions. The filtrate from the resin was sweet and demulcent and afterward bitter, shaken up with ether it yielded a resinous substance to that solvent. The liquid treated with ammonia and then shaken with ether, yielded up no alkaloidal body, but a white granular scum remained on the stratum between the two liquids; benzol added and agitated with the alkaline liquid separated the bitter alkaloid in an amorphous condition, the quantity however was too small to admit of anything approaching a complete analysis.

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MUSSÆNDA FRONDOSA, *Linn.*

Fig.—*Wight Ill. t.* 124; *Rheede Hort. Mal. ii., t.* 18.

Hab.—Tropical Himalaya, Western Peninsula. Leaves, fruit, flowers and root.

Vernacular.—Bebina, Sribar (*Hind.*), Srivadi (*Mal.*), Vella-ellay (*Tam.*), Srivar, Srivardoli, Bhútkes, Lavasat (*Mar.*), Asari (*Nipal*).

History, Uses, &c.—This is a well-known scandent shrub, and easily recognised by its orange-coloured flowers, which contrast prettily with the white calycine leaf, making it a very remarkable object. All the flowers do not produce this leaf-like sepal, but two or three in each corymb, and occasionally two sepals are thus developed. *M. frondosa* is called Srivati in Sanskrit, and is a favourite of the goddess of fortune, from its bearing the white mark of Vishnu or Krishna; another name for it is Nagavalli. Among the Tamil people it is called the "white-rag plant." The flowers are used in country places to make the garland which is tied over the doorway on festive occasions. The root in 80-grain doses is given with cow's urine as a remedy for jaundice (pandu-roga), or two tolas (360 grains) of the white leaves may be given in milk. The juice of the leaves and fruit, which is very mucilaginous, is used as an eye-wash. Rheede says:—The root in decoction expels phlegm, externally applied it is cooling, boiled in oil it cures aphthæ. According to Loureiro, the flowers are attenuant and diuretic, and are used in cough, asthma, ague, and flatulence; externally applied they clean foul ulcers, and cure skin eruptions. In Mauritius a species of Mussænda is called "wild cinchona" and is used as a tonic.

Chemical composition.—A bitter principle, having the peculiarities of a glucoside, pervades all parts of this plant. It was soluble in water and rectified spirit, afforded a reddish brown colour with sulphuric acid, passing from a fine red to a purple, and was not precipitated by alkaloidal reagents or by tannin. Evaporated with an excess of hydrochloric acid, the purple colour was developed, and boiled with the acid, the bitterness of the solution was reduced, a brown decomposition product separated, and the filtrate readily reduced Fehling's solution. The taste was very bitter and acrid, and the glucoside was not obtained in crystals. The aqueous solution of the ether extracts of the various parts of the plant contained a yellow colouring matter related to the quercitrin group, and a colouring matter of the nature of an organic acid was present in the alcoholic extracts, precipitated by acids, and redissolving with the formation of an orange colour in alkalies.

A proximate analysis was made of the white calycine leaves, the fruits, the green leaves, and the mixed stem and root barks. On comparing these results, there is seen to be a correspondence on the one hand between the composition of the calycine leaves and fruits, and on the other hand between that of the green leaves and bark,—results which might naturally be expected, seeing that the calycine leaf is merely an expansion of the ovary-coat, and the leaves act the part of elaborating principles to be stored up in the bark and root.

	Calycine leaves.	Fruit.	Leaves.	Bark.
Ether extract	4·3	8·8	5·0	15·7
Alcoholic ,, ...	28·7	27·3	15·1	17·3
Aqueous ,, ...	11·5	13·4	13·8	9·4
Crude fibre	32·4	33·2	38·3	39·3
Albumen, &c. by difference	15·1	8·5	16·4	7·0
Ash........................	8·0	8·8	11·4	11·3
	100·0	100·0	100·0	100·0

The bark contained the largest quantity of ether-soluble resin, which was yellow, opaque, tasteless and very tenacious. In the leaves the resin was associated with a fat, and in the calycine leaves with a wax. The fruits and calycine leaves contained larger quantities of sugar than other parts of the plant, as seen in the figures for the alcoholic extracts. The aqueous extracts contained mucilage and colouring matter, the former predominating in the leaves and fruits. The

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albuminous matter was most abundant in the expanded parts of the plant.

The fruits were specially examined for alkaloids, but with negative results; they were much more bitter and acrid than the leaves, and would not be acceptable as an article of diet. Notice has recently been taken of an article called "Mussænda coffee" found in the isle of Réunion; but an investigation of the subject proved that the fruits and seeds were those of *Gærtnera vaginata*, a loganiaceous plant, and that chemically they were destitute of an alkaloid. (*Kew Bulletin*, December 1889).

RANDIA DUMETORUM, *Lam.*

Fig.—*Lam. Ill. t.* 156, *f.* 4; *Wight Ic. t.* 580; *Roxb. Cor. Pl. t.* 136.

Hab.— Throughout India. The fruit.

Vernacular.— Mainphal, Mindhla, Pinda (*Hind.*), Mindhal (*Guz.*), Gela, Gelaphal, Peralu (*Mar.*), Menphal (*Beng.*), Marukkallán-kai (*Tam.*), Mangáre-bongáre (*Can.*).

History, Uses, &c.—Mainphal is described by Sanskrit writers under the name of Madana as pungent and dry, and beneficial in leprosy and phlegmatic swellings, the best or safest of emetics; one ripe fruit is said to be a sufficient dose; emesis is generally promoted by a drink containing bitters and aromatics. It is indispensable at the marriage ceremonies of the Vaisya caste, being tied upon the wrists of both bride and bridegroom along with the fruit of *Helicteres Isora*. The Mahometan physicians of India have adopted it as a substitute for the Jouz-el-kai of the Arabs; they describe it as an emetic which expels bile and phlegm, at the same time acting as an aperient; it should be administered in combination with aromatics and honey. Ainslie says:—"The Vytians consider it amongst their best emetics, and prescribe it in the quantity of about one pagoda weight. It is given commonly in the form of powder, the whole nut, seeds included, being powdered." An infusion of the bark of the root is administered to nauseate in

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bowel complaints. Roxburgh in his Coromandel Plants observes that the nut bruised and thrown into pools where there are fish intoxicates them, in the same way that *Cocculus Indicus* does. This practice may be observed in the Concan, where the fruit is well-known as a fish-poison, and is also mixed with corn to preserve it from insects. Mr. Moidín Sheriff, in his *Supplement to the Pharmacopœia of India*, says:—"It is certainly not a good emetic if used as is generally done by powdering the whole nut. The thick shell and the numerous hard seeds are not emetic at all; indeed, if anything they are slightly irritant; only the dry pulp or mucus, which is the least part of the nut, possesses emetic and nauseant properties. The contents of two to three nuts are generally a sufficient dose; they should be bruised, macerated for ten or fifteen minutes in three to four ounces of water, rubbed and strained through cloth. The draught is now ready for use, and produces nausea and vomiting in about ten minutes; emesis should be promoted by the administration of warm water. The ejected matter contains a large quantity of frothy mucus." Mr. Sheriff has found the drug a good substitute for Ipecacuanha in dysentery. He recommends the powdered pulp as the most convenient form for administration. Dose, 40 grains as an emetic; 15 to 30 grains in dysentery, according to the severity of the disease. In colic the fruit is rubbed to a paste with rice water and applied over the navel.

Description.—The dried fruit is about the size of a crab apple, globular or oval, reddish brown, crowned with the rim of the calyx, and in a fresh state has a strong odour of recently tanned leather. It consists of a pericarp and shell, which contains the seeds embedded in pulp. The shell is hard and thick, 2-celled, the dividing septum being thin and membranous. The pulp is grey, and has a nauseous taste and smell. The seeds are small and oblong, about 1½ lines in length, slightly flattened, very hard and of a brown colour, and 100 on an average are contained in each fruit. The average weight of the fruit is about 60 grains, of the pulp separated from the seeds 15 grains.

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Microscopic structure.—The greyish pulp surrounding the seeds is composed of large oval cells containing a little granular matter. The pulp of the pericarp is remarkable for numerous large reddish-brown stony cells. The epidermis is formed of tessalated cells of irregular size and shape. The albumen of the seeds is horny and translucent.

Chemical composition.—The active principle of the fruits is saponin, which forms a large proportion of the pulp surrounding the seeds. The fresh pulp was mixed with water and the juice expressed; the filtered liquor had the following properties:—It was acid in reaction and very frothy, it gave opaque white precipitates with diluted mineral acids, a greenish colour and transparent jelly with ferric chloride, a yellow colour with caustic soda, no reaction with iodine, and no precipitate with two volumes of rectified spirit. Acetate of lead caused such a thick mixture as to allow the vessel to be inverted without the contents flowing out. A measured quantity of the solution, representing a weighed quantity of the dried pulp, was boiled for one hour with dilute HCl, after which the insoluble sapogenin was weighed and the increase of glucose was determined in the filtrate. Calculations from these results showed that the pulp contained about one-third its weight of saponin, and that on an average about four grains of this principle existed in each fruit.

An extract was also obtained by exhausting the pulp with hot spirit and evaporating the united liquors to dryness. This extract was soluble in water, except a little waxy matter, and the solution was acid and frothy. It gave a green coloration with ferric chloride, turning red with ammonia, yellow precipitates with barium hydrate and the acetates of lead, a red colour with caustic soda, and negative reactions with gelatine and iodine solutions and alkaloidal tests. This solution gave a precipitate when boiled with dilute acid, and showed an increase in glucose corresponding with that obtained in the decomposition of saponin. Evaporated portions of the solution produced a purple colour in contact with strong sulphuric acid.

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The pericarp contained some of the principles peculiar to the pulp, such as saponin, wax, resin and colouring matter, and in addition a volatile odorous body of the nature of a soluble fatty acid, which was obtained by distillation and formed soluble salts with silver and barium. A portion of the distillate was neutralized with caustic soda, and carefully evaporated to dryness. The residue was crystalline, deliquescent, soluble in rectified spirit, and sweetish to the taste; treated with sulphuric acid the odour of valeric acid was liberated, and this acid no doubt existed in the pericarps of the fresh fruits in a free state.

The unripe fruits of **Randia uliginosa**, *DC., Wight Ic. t.* 397, are astringent; roasted in hot ashes they are used as a domestic remedy for diarrhœa and dysentery. When ripe they are cooked and eaten as a vegetable. They are of a yellow colour, and have the appearance of a small pear. The structure of the fruit is similar to that of *R. dumetorum.* It is called Pindálu or Pedalu in Hindi, Pinglu in Guzarathi, Chuvadialu or Piralu in Bengali, Pendhári Pendhru or Péndhar in Marathi, Nalaika in Telugu, Wagata in Tamil, Karé in Canarese, and Pindálu or Pindáluka in Sanskrit; and is described as sweet, cooling, and diuretic.

GARDENIA GUMMIFERA, *Linn. f.*

Fig.—*Thunb. diss. Gard., t.* 2, *f.* 3.

Hab.—Western Peninsula, Chittagong, Burma. The resinous exudation.

Vernacular.—Dikamáli (*Hind., Guz.*), Dikémáli (*Mar., Can.*), Kumbai, Dikamali (*Tam.*), Tella-manga, Chiaka-ringuva (*Tel.*).

History, Uses, &c.—This remarkable substance is supposed to be the Nadi-hingu, Hingu-nádika or Pindahva of Sanskrit writers, and is used by the Hindus in fever, dyspepsia, flatulence, and chronic skin diseases. In veterinary practice, it is much used to keep flies from sores, and some European physicians have used it to expel round worms with success.

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G. lucida yields a similar exudation, and Roxburgh states that the fruit of *G. campanulata* is used as a cathartic and anthelmintic, and to remove stains from silk. In the Concan, the root of *G. florida*, rubbed into a paste with water, is applied to the top of the head as a remedy for headache during pregnancy, and is also given internally in hysteria, alone, or combined with *Bharangi* (*Clerodendron serratum*).

Description.—Commercial Dikamali occurs in the form of irregular flat cakes, of a dull olive green colour, more or less mixed with bark, sticks, and the leaf-buds of the plant. The odour is peculiar and offensive, like that of cat's urine. The resinous exudation, if carefully collected from the leaf-buds, is transparent and of a bright golden yellow; it dissolves rapidly in rectified spirit, forming a solution of the colour of pale sherry, which, when poured into water, forms a delicate primrose-coloured emulsion. This after standing for 24 hours deposits a portion of the resin in an opaque condition, and of the colour of precipitated sulphur, but not in sufficient quantity to visibly affect the colour or opacity of the emulsion.

Chemical composition.—Dikamáli contains two resins, one soft and of a greenish colour, the other crystalline and of a golden yellow. The latter was discovered by Stenhouse (*Phil. Trans.* 1856, *CXLVI.*, 155, and *Ann. Chem. Pharm. XCVIII.*, 316), but the amount of *gardenin* obtained at that time was insufficient for a satisfactory analysis. Stenhouse and Groves operating with a larger quantity of the resin found that the best method of obtaining the crude gardenin was to boil the resin with alcohol, filter the solution to separate the insoluble residue, consisting chiefly of small fragments of bark and wood, and allow it to cool. It then deposited almost the whole of the gardenin in slender pale yellow needles, which were collected and washed with cold spirit, to free them from the amorphous greenish yellow resin, which forms by far the larger portion of Dikamáli gum. These needles, however, even after several crystallizations from alcohol, were found to be still impure, being contaminated with a colourless substance

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of low-melting point, somewhat resembling a fat in appearance. After repeated trials in various ways, it was found that this impurity might be removed by means of light petroleum. A boiling saturated solution of the gardenin in alcohol was allowed to cool, and the almost pasty mass of crystals was agitated with light petroleum at a temperature of about 30°, the clear liquid poured off, and the residue again agitated with petroleum, repeating the operation several times. The gardenin was finally purified by alternate crystallization from hot benzine in which it is readily soluble, and from alcohol.

When pure, gardenin forms brilliant deep yellow crystals, which melt at 163° to 164°. Dried at 100°, and burnt in a current of oxygen, it gave the following results:—

I. 0·249 gram. of substance gave 0·567 gram. carbonic anhydride, and 0·119 gram. of water.

II. 0·202 gram. of substance gave 0·457 gram. carbonic anhydride, and 0·102 gram. of water.

		Theory	I.	II.	Mean.	Flückiger.
C_5	60	61·86	62·12	61·70	61·91	59·47
H_5	5	5·16	5·31	5·60	5·45	6·71
O_2	32	32·98	......	......	......	......
	97	100·00				

Flückiger's numbers do not agree with these, but as the specimen he analysed had merely been purified by repeated crystallization from spirit, it is not impossible that it was contaminated with traces of the colourless fatty substance mentioned above. This is rendered very probable by the much lower melting point (155°) which he obtained. It was stated in the earlier paper (Stenhouse *loc. cit.*), that when gardenin is digested with concentrated nitric acid, it is rapidly decomposed, picric acid, but no oxalic acid, being produced. On repeating the experiment, however, this statement was found to be incorrect; gardenin when boiled with nitric acid, dissolves with evolution of nitrous fumes, forming a yellow solution, which on evaporation leaves a yellowish residue; this, however, on careful examination, proved to be quite free from trinitrophenol. It was noticed in making this experiment, that at the moment the gardenin came in contact with the nitric acid, it assumed a brilliant crimson colour before dissolving. The attempts made to isolate the red substance thus formed were ultimately successful; one part of gardenin was dissolved in about thirty times its weight of boiling glacial acetic acid, and after being rapidly cooled two parts of nitric acid of sp. gr. 1·45 were added to the clear solution. In a few seconds hair-like crimson needles began to form, very different in appearance from gardenin. At the expiration of five minutes, the mixture, which was kept cold, had solidified to a pulp of needles. It was then mixed with about 150 parts of cold water, and the gelatinous precipitate collected after it had stood a few minutes. The pasty red mass, after being well washed, was pressed into a cake and dried. Gardenin yields nearly 90 per cent. of its weight of this substance, which is insoluble in water and dilute acids, but readily soluble in alkaline solutions, and reprecipitated on the addition of an acid. It has been provisionally named *gardenic acid*. It is free from nitrogen, and after being purified by boiling with spirit, in which it is but very slightly soluble, and crystallization from glacial acetic acid, it was found to melt at about 236°. (*Phar. Jour. and Trans., July 21st,* 1877.)

Commerce.—Dikamáli is collected by hand, the leaf bud with the drop of resin attached to it being broken off. It is sometimes made into circular cakes of about a pound weight; at other times it occurs in large irregular masses, often very impure. Value, Rs. 3-12 per maund of 37½ lbs.

Canthium parviflorum, *Lam.*, a small thorny shrub of the Western Peninsula and Ceylon, called *Kirni* in Marathi and *Karai-cheddi* in Tamil, is noticed by Ainslie as having medicinal properties. He says:—"A decoction of the edible leaves, as well as root of this plant, is prescribed in certain stages of flux, and the last is supposed to have anthelmintic qualities, though neither have much sensible taste or smell." (*Mat. Ind. ii.,* 63.) This shrub is best known for its edible

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fruit, which is an obovate compressed drupe of a reddish-brown colour about the size of a horse bean; it is sweet, and contains two seeds.

Canthium didymum, *Roxb. Mallea, Varsangi* (*Mar. Naum-pápala* (*Tel.*), has leaves which smell like coriander. The pounded bark is applied by the natives to fractures.

These plants have really little, if any, medicinal qualities.

Vangueria spinosa, *Roxb.*, is the *Pinda* and *Pinditaka* of Sanskrit writers, who consider the fruit to be medicinal, and describe it as strengthening, cooling, and an expellant of phlegm and bile. It is a small tree or large bush, common in many parts of India, from Northern Bengal to Canara, which bears cymes of greenish flowers; the fruit is a drupe, the size of a cherry, of a yellow colour when ripe, subglobose or turbinate, smooth and fleshy, pyrenes 4 to 5, woody, smooth.

The vernacular names are Pundrika, Pinditak (*Hind.*), Mayna (*Beng.*), Pedda-manga (*Tam.*), Vadanike, Chega-gadda (*Tel.*), Chircholi, Madanvriksh (*Mar.*), Maggare-gida (*Can.*).

PAVETTA INDICA, *Linn.*

Fig.— *Rheede Hort. Mal. v., t.* 10; *Wight Ic., t.* 148.

Hab.— Throughout India. The root and leaves.

Vernacular.—Kukura-chura (*Beng.*), Pápari, Kankra (*Hind.*), Pavuttay-vayr (*Tam.*), Páputta-vayroo (*Tel.*), Pápadi (*Mar.*), Pappadi (*Can.*).

History, Uses, &c.—This shrub, which is common on hilly ground, is called Pápata and Tiryakphala in Sanskrit. It is the Malleamothe of Rheede, who says that the leaves are used as manure, and a decoction of them as a fomentation, and that the root with ginger is given in dropsy. Ainslie says:—"This is a bitter but not unpleasant tasted root, possessing at the same time aperient qualities, and is one of those medicines commonly prescribed by the native doctors in visceral obstruc-

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tion; given in powder to children, the dose is about a drachm or more.

Description.—The root is crooked, from 1 inch to ¼ inch in diameter. The bark is grey, with a light brown papery epidermis, and seems to be the most active part. It has a sweetish aromatic taste followed by a bitterness. A section placed under the miscroscope shows large laticiferous vessels, containing a greenish latex, and a parenchymatous structure containing many small starch granules. It is not an article of commerce.

Chemical composition.—The powder gave off a pleasant odour when boiled with water, and a greenish resinous scum separated on the surface of the liquid. The decoction showed the presence of starch, the absence of tannin, and contained a coloured organic acid. Alcohol removed the active bitter principle of the root, and after separating the resin by precipitation with water, the solution when evaporated was perfectly crystalline. The residue was insoluble in ether, but boiling chloroform formed with it a solution from which the bitter principle separated on cooling in white transparent needle-shaped crystals. These crystals were very soluble in water and alcohol, and reduced Fehling's reagent. With sulphuric acid they turned reddish brown, changing to violet; with Fröhde's reagent crimson, changing to green. Warmed with diluted sulphuric acid and potassium bichromate they gave off the odour of salicylol. They melted at 120° C. to an amber-coloured liquid, at a higher temperature to a rich red-brown colour, further heating carbonized them, and inflammable smoky vapours were given off leaving no ash. This bitter glucoside is closely related to salicin, but differs from that substance in its optical inactivity and its greater solubility in water.

IXORA COCCINEA, *Linn.*

Fig.—*Wight Ic.*, *t.* 153; *Bot. Reg.* 513 *and* 154. Jungle Geranium (*Eng.*).

Hab.—Western Peninsula. Cultivated elsewhere.

Vernacular.—Rangan, Rajana (*Beng.*, *Hind.*), Bakura, Pentgul (*Mar.*), Vitchie (*Tam.*).

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History, Uses, &c.—The shrub is sacred to Shiva, and Don is probably correct in stating that the generic name is derived from that of a Malabar idol. The Sanskrit word Ishvara, which signifies god, and especially Shiva, would be written Ixora in Portuguese, and nothing can be more probable than that the first explorers of the Malabar Coast, on learning that the plant was sacred to Ishvara, should name it after that god. In Southern and Western India the Hindus use the bright red flowers, probably in accordance with the doctrine of signatures, as a remedy for dysentery. In the Concan they are fried in melted butter, rubbed down with a little cumin and nágkesar (cinnamon buds), and made into a bolus with butter and sugar-candy. In Southern India they are given with tyre or goat's milk. Rheede notices the use of the root in fever and gonorrhœa, also its external application in headache, and to boils, with or without cocoanut milk. The root was brought to the notice of the profession a few years ago as a remedy for dysentery by a medical man in Bengal, but Dr. F. Willis reports:—"I tried it in many cases, but only in a small number did I find it of any benefit, one case only was cured without other drugs; it is, however, a very good stomachic tonic, useful in cases of debility of that organ, and that I think is its proper place in therapeutics."

Description.—Root branched, ¼ inch or more in diameter; bark thick, smooth, brown, marked with small warty prominences, it exudes a yellow juice when cut; wood hard, yellowish; odour rancid and disagreeable. Commencing from the exterior the bark, when viewed under the microscope, presents several rows of brick-shaped cork cells of a brown colour; the parenchyma is loaded with starch cells, and permeated towards the inner part by yellow laticiferous vessels, just without these is an interrupted zone of yellow stone cells. The wood is porous with strongly marked medullary rays.

Chemical composition.—The root had no peculiar taste, but a slight odour of volatile fatty acids developed on boiling the powdered root with water. Ether separated a yellow oily liquid, the aqueous solution of which was very acid and had an odour of butyric acid. A tincture of the root was red in colour, astringent to the taste, and very acid in reaction. Evaporated to dryness and heated with water, the solution gave evidence of a tannin by giving a green precipitate with ferric chloride, pinkish with gelatine and bulky brown with iodine. The insoluble portion yielded to petroleum spirit one or more fatty acids, liquid at 20° C., and the red precipitate insoluble in this medium was soluble in spirit and soda solution, and consisted of oxidized tannin. A white crystalline substance was associated with the tannin in the aqueous solution of the alcoholic extract, and gradually formed in small quantity when the evaporated solution was set aside for a few days. The flowers have the delicate odour of cinchona flowers, and contain a colouring and astringent principle of the nature of an organic acid. The red colour is imparted to water more readily than to alcohol, but the latter separates it in a purer condition. The aqueous solution is blackened by ferric chloride, precipitated by gelatine, destroyed in brilliancy by fixed alkalies and restored by acids. Ammonia renders the solution dichromatic, and lead acetate throws down the colouring matter as a greenish blue precipitate, containing 32·9 per cent. of oxide. Ether removes a wax and a yellow colouring matter related to quercitrin. Alcohol and water respectively remove from the drug the same amount of extract, namely, 30 per cent., consisting largely of saccharine matter. The astringent colouring matter occurred to the extent of 5·7 per cent., and the papers used in filtering the solutions retained a small quantity of the colour, which changed to blue by exposure to the air, and this paper acted as litmus in turning red with the least trace of acid. The ash was 6·4 per cent.

The flowers of **Ixora parviflora**, *Vahl.*, the Torch tree, pounded in milk, are given for whooping cough, and at the same time a necklace of the flowers is worn. This evergreen shrub or small tree is common in many parts of India, and the Dâk (Post office) runners make torches of it. The vernacular names are Kotha-gandhal (*Hind.*), Rangan (*Beng.*), Raikura

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Mákadi (*Mar.*), Gorabikattige (*Can.*), Shulundu-kora (*Tam.*), Kachipadel (*Tel.*).

COFFEA ARABICA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 1303; *Bentl. and Trim.* 144. Coffee bush (*Eng.*), Cafeier (*Fr.*).

Hab.—Africa. Cultivated elsewhere. The seeds.

Vernacular.—Kahvah (*Arab.*, *Ind. Bazars*). Corruptions of the English name are now in general use among the natives.

History, Uses, &c.—The plant is a native of tropical Africa; it grows gregariously in woods at an elevation of 1,000 to 2,000 feet or more. It is common in Abyssinia, whence it was introduced into Arabia by the Arabs, and through them the seeds became known to the Persians and Turks. The date of the introduction of coffee into Arabia is uncertain, the first Arabian writer who mentions *bunn* (coffee berries) is Firuzabadi in the Kámus, which work was, according to the original copy, written by himself, completed A.H. 768 (A.D. 1366). He describes *bunn* as a certain thing which is taken like the condiments termed مری (murriye). Ibn-es-Simani says, "It is a thing reckoned among what are termed كوامخ (kawámíkh) which signifies the same as Murriye. The physician Dawood, says: "It is the produce of a certain tree in El Yemen, which grows to the height of about three cubits, on a stem of the thickness of the thumb, and has a white flower, which is succeeded by a berry, like the hazel nut; sometimes it is cut like beans; and sometimes, when it is divested of its covering, it divides into two halves: it has been proved to be good for alleviating humidities and cough and phlegm and defluxions, and for opening obstructions, and causing a flow of the urine: when roasted (and pounded or ground) and well cooked (*i.e.*, boiled in water), it is now commonly known by the name of قهوة (kahvah)." (*Lane, in Madd-el-Kamus.*) Kahvah in Arabic signifies 'wine' or 'that which causes appetite,' and, before coffee was known to the Arabs, was applied to some other stimulating drink (probably kât), which they were in the habit of using. Coffee is not mentioned by Haji Zein-el-Attár, who wrote in A.D. 1368; consequently, it cannot have been known in Persia at that date. Though coffee was known to the Arabs as a medicine in the 14th century, coffee-drinking does not appear to have been practised until the early part of the 15th century, when, according to some authorities, Jamal-ed-deen Abu Abdulla Muhammad bin Said-ed-Dabáni, Kadi of Aden, returning from Abyssinia, where the practice is said to have existed from a very early date, introduced it at Aden, whence its use gradually spread through Arabia to Persia and Turkey. Another account of its introduction as a drink in Arabia is that the disciples of Sheik Abul Hasan Shadali, who had a cloister on the mountains of Yemen, being much worn out by fasting and constant vigils, accidentally ate some of the berries of a coffee bush, and finding them very refreshing, told the Sheik of their discovery, upon which he ordered them to use a decoction of the fruit as a drink. When first introduced the practice of coffee-drinking met with much opposition both in Arabia and Persia, and its use was prohibited by some of the Mahometan law doctors. A Persian rhymster says of it:

آن سیه رو که نام او قهوه است .:. مانع النوم و قاطع الشهوه است

i.e.—That black-faced drink called coffee is the preventer of sleep and destroyer of manhood. On the other hand, its admirers were not silent, as will be seen from the following lines:—

راحیست قهوه روح فزا و کسل کسل .:. آرام جان و قوت اعضا و قوت دل
تقریب اجتماع جوانان پارسا .:. تفریح بخش خاطر پیران مضمحل

Coffee is a wine which induces a feeling of well-being and ease;
It soothes the mind and strengthens the limbs and heart.
It ministers to the pleasures of the youth of Persia,
And alleviates the pangs of decrepid old age.

According to Indian tradition the Coffee plant was introduced into Mysore by a Bábu or wandering monk, named Abu-din, who about A.D. 1650 came and took up his abode on the uninhabited hills in the Nugger division, named after him, and where he established a college, which still exists, endowed by the Government. It is said that he brought seven

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coffee berries from Mocha, which he planted near his hermitage, about which are now to be seen some very old coffee plants. (*Drury.*)

Coffee-drinking was introduced into India by the Persian invaders, but its use appears to have been confined for a long time to the entourage of the Moghal Court, as Linschoten, who was in India from 1576 to 1590, does not mention the berry among the articles of trade found in the Portuguese Settlements in the East. Rauwolff is the first European writer who notices it, having observed its use at Aleppo in 1573. In 1592, Prosper Alpinus published a figure and description of the plant from a cultivated specimen he saw in a garden in Egypt. For some time after this, Cahué, Coffa, or Kauhi as it is written in an Arabic and English pamphlet printed at Oxford in 1659, appears to have been known by name only to the learned in Europe, as Burton in his *Anatomy of Melancholy,* which was published in 1621, says, "The Turks have a drink called coffee (for they use no wine), so named of a berry as black as soot, and as bitter (like the black drink which was in use amongst the Lacedæmonians, and perhaps the same), which they sip still of, and sup as warm as they can suffer," &c.

Coffee-drinking began to be practised in Western Europe by Turkey merchants in 1650, and in 1652 it was introduced into London, when one Pasqua Rosee, the Greek servant of a Turkey merchant named Edwards, opened a house to sell it publicly in St. Michael's Alley, Cornhill. There appears to have been much prejudice for a long time against *the Turkish berry as black as soot and as bitter,* as in 1663 a poetical satire, entitled "*A Cup of Coffee or Coffee in its colours,*" appeared, in which it is stigmatized as—

> "A loathsome potion, not yet understood,
> Syrop of soot, or essence of old shoes,
> Dasht with diurnals and the book of news."

And in the "Women's Petition against Coffee," 1674, they complained that "it made men as unfruitful as the desert whence that unhappy berry is said to be brought." As late as 1711, we find the following passage in a letter written by

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Charlotte Elizabeth from Marly to her step-sister in Germany: "I am grieved to learn, dear Louise, that you have taken to coffee; nothing is so unhealthy, and I see many here who have had to give it up because of the diseases it has brought upon them. The princess of Hanan died of it in frightful sufferings. After her death they found the coffee in her stomach, where it had caused several ulcers. Let this then be a warning to you."

Coffee is cultivated by the Arabs in the lower valleys of the mountains of Yemen, the plant is watered regularly morning and evening, and takes three years to arrive at maturity, when it forms a shrub from 7 to 11 feet in height. A good bush of *Oudanee* coffee produces 28 lbs. yearly. The beans are brought in December and January to Sanaa, from the surrounding districts. They are divided into seven classes, as *sherjee*, the best; *oudanee*, the largest, &c. From Sanaa they are carried to Mocha and Hodeida. The people of Sanaa never use the coffee bean, but employ the husk, which they call "*Khishr*," and which is prepared in the same manner; they say that the bean is too heating, but that kishr is an infallible remedy for all disorders. (*C. J. Cruttenden, Trans. Bom. Geograph Soc. ii.*, 45, 1836.) Cruttenden notices the difficulty experienced by the merchants in forwarding their coffee to Mocha, owing to the Turks having taken possession of the Tehama, and shortly afterwards we find that the trade was to a great extent transferred to Aden.

The Dutch were the first European people to grow the plant at the end of the 17th century at Batavia from Arabian seeds. In 1690 one of these was sent to Witsen at Amsterdam, and the plant soon became known in European gardens. The Dutch also imported the plant into the New World, the first coffee being grown at Surinam in 1718, whence in 1725 it was secretly carried to Cayenne by the French. Its introduction into the West Indies appears to be due to a French naval officer, who in 1720 or 1723 brought the plant to Martinique.

At the present time coffee is cultivated in nearly all tropical and subtropical countries. The berries of some other species are used, especially those of *C. liberica*, Hiern., from the West Coast of Africa. It is a larger and more robust plant, and flourishes at a lower elevation than *C. arabica*; its berries also are larger. Coffee leaves are preferred by the natives of Sumatra to the berries; with boiling water they afford a transparent, brown infusion, which when made sufficiently strong is by no means unpalatable. For full particulars, see *Hanbury Science Papers, p.* 84.

Coffee is prepared in the East from the freshly-roasted berries crushed in a mortar and boiled in water; as soon as the water boils the decoction is ready for use and is taken without sugar or milk in small cups (finján) about the size of a large egg cup, and a glass of cold sherbet is taken immediately after it. It contains therefore hardly any of the caffeine, and its virtues almost entirely depend upon the aromatic products produced during the process of roasting. Coffee prepared in this manner or by a rapid process of infusion produces mental exhilaration, physical activity, and wakefulness. Jomand says, "One hundred and twenty grams of powdered coffee and 3 litres of an infusion made with 200 grams of different kinds of coffee enabled me to live for five consecutive days without lessening my ordinary occupations, and to use more and more prolonged muscular exercise than I was accustomed to, without any other physical injury than a slight degree of fatigue and a little loss of flesh." It appears to us highly probable that all the effects which are stated to be produced by the use of Kola seeds would also be induced by the consumption of coffee berries. Comparative experiments are certainly worth trying.

It has been proved by experiment that under the influence of coffee the amount of blood circulating in the brain is reduced, but that it is brought to the nerve tissues under increased pressure, hence assimilation of nutritive material should be increased in rapidity if lessened in quantity. Prolonged mental labour produces cerebral congestion and drowsiness, it is this condition apparently which coffee corrects by contracting the blood-vessels and lessening the amount of blood in the brain. Coffee like other stimulants quickens gastric digestion, stimulates the secretion of bile, and by augmenting the peristaltic action of the intestine, promotes defecation; but if taken in excess, it paralyzes the digestive function, and causes venous congestion of the liver, constipation and hæmorrhoids. Coffee is often a useful stimulant in asthma, narcotism, delirium tremens, and during convalescence. Experiments upon animals have shown that coffee and caffeine are direct physiological antidotes to morphia. Coffee and caffeine have been used as diuretics in dropsy. Dr. von Schrœder of Strasburg, from experiments which he has made, arrives at the conclusion that caffeine acts powerfully and energetically upon the renal secretion by direct stimulation of the secretory apparatus, but it may also so affect the vaso-motor centres as to diminish the urinary secretion. In order to eliminate the action of the vaso-motor centres upon the secretory apparatus, Schrœder paralysed these centres in animals by means of chloral hydrate. The result was a marked lowering of blood tension. A rabbit of two kilos weight was narcotised with chloral, and canulas introduced into the ureters. Within 70 minutes 50 centigrams of caffeine was injected by three separate operations into the veins. The quantity of urine secreted during this time was about eleven times greater than under normal conditions. Here the caffeine appeared to act directly upon the renal epithelium. To demonstrate this more clearly, Schrœder cut the nerves of one kidney, leaving those of the other intact. All vaso-motor influence over one kidney was thus prevented, while to preserve it intact over the other, the animal was narcotised with morphia before the experiment. When caffeine was now introduced into the blood of the rabbit, there was a much greater urinary secretion from the kidney, the nerves of which had been divided, than from the other.

The diuretic action of caffeine has hitherto been misunderstood owing to the double influence which it exerts, *viz.*, excitation of the nerve centres like strychnia, and stimulation of the secretory elements of the kidney, the latter being often completely neutralised by the former. Schrœder compares this double action of caffeine to that of pilocarpine. Small

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quantities of these alkaloids are sufficient to cause a specific secretion. He considers that the action of caffeine demonstrates the glandular nature of the kidney and shows that it is not a simple filter. (*Nouveaux Remèdes, Mars* 24, 1887.)

To illustrate the toxical effects of coffee, the following examples may suffice: Fifty minutes after taking a drachm of citrate of caffeine a burning sensation in the throat was complained of, and giddiness with vomiting, purging, and abdominal pain. General paresis with tremor ensued, followed by collapse, but the mind remained clear (*Routh, Practitioner*, xxxi., 48). Fort took an infusion of eight ounces of coffee in a quart of water in the course of a day. The pulse rose to 114, sleep was impossible, muscular spasms occurred all over the body, and were very painful in the extremities, chest, and throat. The tongue was dry, there was nausea with frequent liquid stools, and the pulse ranged from 110 to 114, and was intermittent. The next day there was headache and anorexia. (*Bull. de Thérap., civ.* 350.) The experiments of Lüderitz upon cultivations of various bacteria (*Berl. Klin. Wchenschr.*, 1890,) show that tincture of coffee possesses marked antiseptic properties. These properties cannot be due to caffeine, which has little effect as a germicide, the tannin may exert some influence, but it is probably the products formed during roasting which are the most active agents. It is remarkable that a cup of coffee may be exposed to the air in a room for a week or two without the appearance of any micro-organisms in it.

Description.—The seeds are oval, longitudinally grooved upon the flat side, usually almost completely deprived of the parchment-like, finely-wrinkled testa, fragments of which remain in the groove and sometimes upon the back. The horny albumen is of the shape of the seed, according to the variety, of a yellowish, brownish, bluish, or greenish tint, and is folded, or rather rolled up, whereby the groove is produced. The embryo is situated under the convex side near one end, is slightly curved, and occupies about one-fourth the length of the seed. Raw coffee has a very faint odour and a sweetish,

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slightly astringent, and bitterish taste. The commercial varieties vary considerably in flavour, in size, and in the shade of colour. On keeping, coffee loses during the first year about 8 per cent. in weight, principally moisture ; during the second, 5 per cent., and during the third year 2 per cent., the flavour being at the same time greatly improved.

In Mocha coffee the seed is often quite ovoid, only a single grain being contained in each fruit.

Chemical composition.—The sweetish pulp of the pericarp contains several sugars, of which Boussingault (1881) found 2·37 per cent. cane-sugar, 8·73 per cent. invert-sugar, and 2·21 per cent. mannit. According to Payen's analysis (1849), coffee contains 13 per cent. of fat, 15·5 of glucose, dextrin, and an undetermined vegetable acid, 10 of vegetable casein, 5 of chlorogenate of caffeine and potassium, 3 of nitrogenized principle, 0·8 of caffeine, 0·001 of solid volatile oil, 0·002 of liquid aromatic principle soluble in water, 6·7 of ash, and 1 of moisture, the remainder being cellulose. The fat consists of palmitin and olein. The acids contained in coffee have been the subject of repeated investigations. These render it probable that, besides a little citric acid, the principal one is *caffeo-tannic acid*, which, according to Rochleder, is Payen's *chlorogenic acid* ; its precipitate with gelatin is soluble in the tannin solution ; tartar emetic does not precipitate it, but it yields with lead salts and baryta solution yellow precipitates. Vlaanderen and Mulder (1858) separated this principle under the name of *caffeic acid*, and regard the other acids of coffee (*caffeanic*, *cærulic*, and *caffeelic*) as products of oxidation ; and they believe the various colours of raw coffee to be due to mixtures of these derivatives. They consider chlorogenic as a mixture of their caffeic and cœrulic acids ; Rochleder's *viridinic acid* (1848) may be a similar mixture. The *caffeic acid* of Hlasiwetz (1867) is obtained by continued boiling of caffeo-tannin with excess of potassa solution and separation by sulphuric acid. When pure it has the composition $C^9H^8O^4$, is in straw-yellow crystals, forms mostly yellow-coloured salts, and, like the amorphous gum-like caffeo-tannin, yields with fusing potassa protocatechuic acid, $C^7H^6O^4$. By dry distillation pyrocatechin is obtained. Zwenger and Siebert (1861) obtained from Java coffee 0·3 per cent. of kinic acid, which is most likely the coffeic acid of Stenhouse, obtained (1854) from coffee-leaves, and which readily yielded kinone when treated with manganic deutoxide and sulphuric acid. (*Stillé and Maisch.*) König and others have obtained the following results from the analysis of coffee from four various sources:—

	König.		Payen.	Smethan. Roasted average of seven varieties.
	Raw.	Roasted.	Raw.	
Substances soluble in water.	27·44	27·45	......	
Nitrogen	1·87	2·31	......	2·26
Nitrogenous matter	11·43	12·05	11· to 13	
Caffeine	1·18	1·38	·8	
Caffetannic acid	...	...	3·5 to 5·	
Fat	13·23	15·03	10· to 13·	10·99
Ethereal oil	...	...	·013	
Sugar	3·25	1·32	......	
Sugar and dextrin	...	...	15·5	
Other nitrogenous matter ...	31·52	38·41	......	
Cellulose	27·72	24 27	34·	29·28
Ash	3·48	3·75	0·7	4·19
Soluble ash	...	...	......	3·37
Moisture	11·19	3·19	12·	2·87

For information regarding the composition of various coffee substitutes, the reader is referred to König's work already quoted and to Battershall's Food Adulteration.

The roasting of coffee, which is best accomplished at a temperature of about 250° C., renders the seeds pulverizable, and at the same time gives them a more agreeable taste and enables them to yield more of their constituents to water. The coffee thus acquires a chestnut-brown colour and loses about 18 per cent. of its weight. The generation of gaseous compounds ruptures the cells, and a peculiar and agreeable aroma is produced, probably through the decomposition of the fat and

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tannin. But Payen's (as well as Rochleder's) investigations failed to point out the principle to which the changes are due. Very probably they depend upon the decomposition of several of the organic compounds and unquestionably upon the production of a pyrogenated volatile oil, to which the grateful aroma is due. Caffeine does not partake of these changes, except that it is slowly volatilized at the temperature stated; hence the roasting of coffee ought to be effected in closed vessels. Bernheimer (1880) found nearly one-half of the products of roasting to consist of palmitic acid, the remainder being acetic acid, carbonic acid, probably acetone, hydroquinone, pyrrol, methylamine, ·18 to ·21 per cent. caffeine, and ·04 or ·05 *coffeol*, $C^{8}H^{10}O^{2}$, to which the aroma of coffee is due; it is an oil boiling at 195° C. (383° F.), and is probably a methyl ether of saligenin. (*Stillé and Maisch.*)

The extract from roasted coffee, mean of eight analyses, had the following composition: 100 parts of coffee yielded to water 25·50 per cent. of extractive, containing ·5 per cent. nitrogen, 5·18 per cent. oil, 13·14 per cent. non-nitrogenous matter and 4·06 per cent. ash. (*König.*)

Mocha coffee yields as much as 7·84 per cent. of ash—consisting chiefly of carbonates and phosphates of potassium, sodium, magnesium, and calcium, the earthy salts amounting to one-seventh or one-sixth of the weight.

The percentage of caffeine contained in raw coffee has been variously stated by different chemists to range from 0·23 (Liebig) to 2·00 (Allen.) Paul and Cownley (*Pharm. Journ., Jan. and Feb.* 1887,) have, however, after examining fourteen different samples of raw coffee dried at 100° C., obtained the following very uniform results:—

Kind of Coffee.	Moisture, p. 100.	Caffeine, p. 100
Coorg........................	8·0	1·20
Guatemala......................	8·6	1·29
Travancore.....................	10·0	1·29
Liberia (1)....................	8·0	1·30
„ (2)....................	8·0	1·39
Rio	9·1	1·20

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Kind of Coffee.	Moisture, p. 100	Caffeine, p. 100.
Santos, Brazil	9·0	1·29
Manilla..........................	6·6	1·20
Ceylon	6·2	1·24
Perak............................	7·3	1·22
Costa-Rica......................	7·2	1·24
Jamaica (pale)	8·7	1·21
Do. (2)	9·0	1·28
Mysore	8·0	1·28

The process for the extraction of the caffeine used by Paul and Cownley was the following:—The coffee in fine powder was mixed with moist lime and exhausted by alcohol in a Waitt's percolator. After removal of the alcohol the dry residue was mixed with a small quantity of water, acidulated by sulphuric acid to convert into sulphate the trace of lime present. After filtration the liquid was shaken with chloroform, and on the evaporation of the chloroform the caffeine was obtained in a crystalline state.

Commerce.—The coffee-cultivating region is Southern India; it supplies most of the coffee consumed in India, and before the coffee blight (which is caused by a fungus, *Hemileia vastatrix*, spreading over the leaves and destroying their functions) it exported large quantities to other countries, as the following figures will show:—

Official years.	Quantities in Cwts.	Value in Rupees.
1878–79..................	341,186	1,54,36,427
1879–80..................	359,313	1,62,67,465
1880–81..................	369,357	1,59,96,688
1881–82...	346,364	1,44,74,650
1882–83..................	353,324	1,39,22,040

Mocha coffee is imported into Bombay, where it fetches nearly double the price of Indian coffee.

Diplospora sphærocarpa *Dalz. Hook. in Kew Journ. ii., p.* 257.

The berries of this tree, growing on the Western Ghauts, are known as "wild Coffee," and, when ripening, are eaten largely by birds and jackals, but they have not been known to be used as a substitute for coffee either by the natives or European planters. The berries are from ½ to ¾ of an inch in diameter, and are crowned by the calycine areole. The seeds, numbering from 4 to 10, are arranged in a vertically imbricate manner in the sweetish pulp, they are round and flattened in shape, glossy on the surface, light-brown in colour and horny in consistence. The seeds turn dark brown when roasted, throwing off the parchment-like testa, and when powdered possess an aroma resembling that of coffee. The roasted and powdered seeds were submitted to Brig.-Gen. A. Kenney-Herbert, a great authority on Indian cookery, and he reported as follows.—"The percolated liquor had a remarkably pleasant taste, having a marked flavour of coffee. Indeed, the only difference I could detect was this:—The liquor was not so dark in tint as coffee, being more golden brown than dark brown, and the beverage brewed seemed not quite so strong as would have been produced by a similar quantity of coffee powder. There can be no doubt of the distinct coffee-like properties of this powder, and the absence of any twang or conflicting flavour to mar its pleasant taste.

The seeds contain an alkaloid, which can be separated in the same manner as caffeine, an astringent acid, an aromatic body, some fat, one or more sugars, and four per cent. of mineral matter. The dried extract obtained by boiling water is 16 per cent., or something less than that obtained from cultivated coffee berries.

MORINDA CITRIFOLIA, *Linn.*

Fig.—*Rheede Hort. Mal. i., t.* 52; *Wight Ill., t.* 126.

MORINDA TINCTORIA, *Roxb.*

Fig.—*Bedd. Fl. Sylv., t.* 220.

Hab.—Throughout India, wild or cultivated. The leaves and fruit.

Vernacular.—A'l, Atchi (*Hind.*), A'l, Baratondi, A'sa, Nagakuda (*Mar.*), Núna-maram (*Tam.*), Ach, Achhu (*Beng.*), Munja, Pavattari (*Tel.*), Maddi (*Can.*).

History, Uses, &c.—The roots of these plants, in Sanskrit Achchhuka, have long been in use as a red dye in India, and the leaves and fruit are used medicinally. A paste of the leaves combined with aromatics is given in diarrhœa and dysentery, and is also used as a tonic and febrifuge. The juice is used as an external application to relieve the pain of gout, and to promote the healing of sores. The fruit is considered to be deobstruent and emmenagogue, and when unripe is eaten as a vegetable in curries. Morinda is extensively cultivated in Malwa; it is sown broadcast or in drills, and the ground ploughed and harrowed. In from 15 to 20 days the seed comes up, the field is then weeded, and the ground stirred. This operation is repeated at intervals during the first year, and in the dry months (January to June) the ground is three or four times irrigated. After the first year no further care is required, and in the third year the plant begins to bear flowers and fruit. In the fourth year the plants are dug up in February and March; one beegah yields from 48 to 72 maunds of wet root, which is allowed to dry in the sun, and then separated into coarse, medium, and fine. A few plants are left for seed until six years old, when the fruit is gathered, placed in heaps, covered with straw and allowed to rot; the seed is then washed out. Wheat or other grain is cultivated between the trees. The root is exported to Guzerat and Hindustan. See *As. Research. iv. p* 40, where an account of the method of dyeing with the root will be found. The plant is also cultivated in Southern India.

Description.—*M. citrifolia* is a small tree with oval, oblong, smooth shining leaves, 10 to 12 inches long, and 4 to 5 inches broad, veins pale, and prominent on the under surface; flowers white, with a long infundibuliform corolla; fruit oblong, 3 inches or more in length, and composed of the succulent enlarged calyces, enclosing many cartilaginous 1-seeded pyrenes; it is of a pale yellowish green colour, and is marked with numerous circular scars; when quite ripe it has an extremely offensive odour like that of putrid cheese. The seeds are black and not unlike quince seeds. *M. tinctoria* is a larger tree, having leaves, flowers and fruit very similar to

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M. citrifolia, but the fruit is smaller, and the leaves are pubescent and in one variety quite tomentose. Some botanists consider it to be the wild form of *M. citrifolia*. Morinda root has a reddish-brown nearly smooth bark, which has a nauseous slightly bitter flavour; the woody portion is hard and of an orange-yellow or reddish-yellow colour. The odour of the freshly dug root is acrid and disagreeable.

Chemical composition.—Anderson has obtained from the root-bark of *M. citrifolia* by exhausting it with alcohol a crystalline principle, *Morindin*, $C^{28}H^{30}O^{15}$, to the presence of which the dyeing properties of the plant are due; after repeated crystallizations from dilute alcohol morindin forms slender yellow needles of a satiny lustre, soluble in boiling water, which on cooling deposits it in gelatinous flakes. Alkalies form with morindin orange-red solutions. Heated in a closed vessel morindin melts, boils, and emits orange vapours, which on condensation form long orange-yellow needles of *Morindon* ($C^{15}H^{10}O^{5}$). Rochleder (*Jahresb. f.* 1851, *p.* 548,) considers morindin to be identical with the ruberithric acid which he has extracted from madder, and morindon to be identical with alizarin, but morindin differs from ruberithric acid in being insoluble in ether and in its behaviour with alkalies; like ruberithric acid it is a glucoside. (*Wurtz, Dict. de Chim., t. ii., p.* 454; *Edin. Phil. Trans., xvi., p.* 434.) Two papers on morindin and morindon will be found in the *Transactions of the Chemical Society* for 1887 and 1888 by Prof. T. E. Thorpe.

Commerce.—One sumai (bundle) of 450 seers or 270 lbs. is worth Rs. 15. The main root is 12 annas per maund, the small roots are more valuable and sell at Re. 1 to Re. 1-8 per maund.

PÆDERIA FŒTIDA, *Linn.*

Fig.—*Griff. Ic. Pl. As., t.* 479, *f.* 3; *Gärt. f. Fruct. iii. t.* 195.

Hab.—Central and Eastern Himalaya, Bengal, W. Peninsula. The plant.

Vernacular.—Gandhali (*Hind.*), Gandhabháduli (*Beng.*), Hiranvel (*Mar.*), Gandhana (*Guz.*), Paedebiri (*Pahâriya*).

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History, Uses, &c.—An article of the Hindu Materia Medica in repute as a remedy for rheumatism. The Sanskrit names are Prásárani, Apehi-vata, "expelling flatulence," and Gandha-bhádáliya. It is the *P. fœtida* of Willdenow (*Spec. I.*, 1219), the Somaráji of the *Asiatic Researches* (IV., 261), the *Convolvulus fœtidus* of Rumphius (*Amb. V.* 436, *t.* 160), and the *Apocynum fœtidum* of Burmannus (*Ind.*, p. 71). The plant is found in most parts of India and all through the Malayan Archipelago, extending from the Mauritius northward to China and Japan; in Assam it is called '*Bedoli Sutta,*' and in China '*Jung-gala*'; it has been lately brought to notice as a fibre-yielding plant; Roxburgh says that the Hindus use the root as an emetic. Rumphius describes it as emollient and carminative, and useful in colic, spasms, rheumatism and gout. Corre and Lejanne say that in Cochin-China it is used as an emetic under the name of *Toud dit.* As a specific in rheumatism, used both internally and externally, it is best known in Hindu medicine. Bháva Misra prescribes an electuary (Prasárani leha), which is made by boiling down a strong decoction of the plant with treacle to the consistence of a thick syrup, and then adding ginger, pepper and Plumbago root. In Chakradatta the method of preparing a liniment (Kubja prásárani taila) will be found. (*Dutt's Hindu Materia Medica, p.* 179.) In the Bombay Presidency the plant is found in the Southern Concan.

Description.—Stem ligneous, twining, young parts round, smooth; leaves opposite, long petioled, oblong-cordate, pretty smooth, entire; stipules broad-cordate; panicles axillary and terminal; flowers numerous, of a deep pink colour; bracts ovate; berry dry, compressed, smooth, with five lines on each side, one-celled, two-seeded; seed compressed, smooth, with a membranous ring all round. (*For fig. see Baillon's Nat. Hist., Vol. VII., p.* 274.) All parts of the plant give off a most offensive odour of bisulphide of carbon when bruised.

Chemical composition.—By distillation with water a volatile oil was obtained, which had the highly offensive odour of the fresh drug. We also obtained evidence of the presence of at least two alkaloids; one was soluble in ether and was deposited in minute needles which assumed an arborescent form: the second alkaloidal principle was only slightly soluble in amylic alcohol, chloroform or benzene; we failed to obtain it in a crystalline form. No special colour reactions were obtained with either principle. We propose provisionally for these principles the names α and β *Pæderine*.

SPERMACOCE HISPIDA, *Linn.*

Fig.—*Rheede Hort. Mal. ix. t.* 76; *Burm. Thes. Zeylan. t.* 20, *f.* 3. Shaggy Button weed (*Eng.*).

Hab.—Throughout India. The roots.

Vernacular.—Madana-ghettu (*Tel.*), Nutti-churi (*Tam.*), Ghanti-chi-baji, Dhoti, Gondi (*Mar.*), Thardavel (*Mal.*), Madana-buntakadu (*Beng.*).

History, Uses, &c.—In Southern India the Sanskrit name of this plant is said to be Madanaghanta, and there is a Hindu myth that an oyster will open its shell if touched by the plant. The seeds are thought to be aphrodisiac, and the plant is prescribed to cure hæmorrhoids. Kirkpatrick says the seeds are cooling and demulcent, and are given in dysentery in doses of one pagoda. Rheede says of it: "Succus expressus cum butyro decoctus lienteriæ prodest." Ainslie states that it is used as an alterative and purifier of the blood like sarsaparilla, and is prescribed in decoction, the dose of which is four ounces or more daily. In the Concan it is eaten along with other herbs as a vegetable. According to Bélanger it is used as a tonic and stimulant in Martinique.

Description.—A procumbent, scabrous, or hirsute herb; root fibrous, annual or perennial; leaves obovate spathulate, oblong or elliptic, obtuse or acute, coriaceous, ½—1½ by ⅓ to ⅔ in.; flowers 4 to 6 in a whorl, blue or white; capsules hispid or pubescent; seeds oblong, granulate, opaque. In some forms of the plant the leaves have cartilaginous edges.

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RUBIA TINCTORIUM, *Linn.*

Hab.—Cashmere, Sind, Afghanistan, Europe. The roots. Madder (*Eng.*), Garance (*Fr.*).

RUBIA CORDIFOLIA, *Linn.*

Fig.—*Wight Ic., t.* 187; *Dcne in Jacq. Voy. Bot.* 84, *t.* 92. Heart-leaved Madder (*Eng.*), Garance à feuilles cordiformes (*Fr.*).

Hab.—Throughout the hilly districts of India. The roots.

Vernacular.—Manjith, Majith (*Hind., Guz.*), Manjitti, Shevelli (*Tam.*), Manjishta, Tamra-valli (*Tel.*), Manjushta (*Can.*), Manjit (*Beng.*), Manjeshta (*Mar.*).

History, Uses, &c.—Madder is used in Hindu medicine as a colouring agent: medicated oils are boiled with madder to give them colour. It is also a useful external astringent, and is applied to inflamed parts, ulcers, fractures, &c. Chakradatta recommends madder rubbed with honey as an application to the brown spots of *pityriasis versicolor*. The Sanskrit name is Manjishtha. Under the names of Fuvvah and Rúnás, Arabic and Persian writers treat of madder, probably the produce of *R. tinctorium.* *

They do not, however, make any distinction between the species, but simply mention a wild and a cultivated variety. The Mahometans consider the drug to be deobstruent, and prescribe it in paralytic affections, jaundice, obstructions in the urinary passages and amenorrhœa.† They mention the fruit as useful in hepatic obstruction, and a paste made from the roots with honey, as a good application to freckles and other discolorations of the skin. The whole plant is reputed to be alexipharmic; it is also hung up in houses to

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* The author of the Makhzan gives Rubis as the European, Dúzarlús as the Greek, and Albisam as the Latin name of madder. *Cf.* Pliny 19, 17; 24, 56, who calls it Rubia and Erythrodanus.

† Cf. Theophr. H. P. ix., 14.

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avert the evil eye, and tied to the necks of animals with the same object.*

Ainslie observes that the hakíms are in the habit of prescribing an infusion of madder root as a grateful and deobstruent drink in cases of scanty lochial discharge after lying-in. (*Materia Indica II., p.* 182.) In another notice of the article (*Op. cit. I., p.* 202), he remarks that it would appear to be chiefly produced in Cachar, and the root is in great demand in the adjacent countries, for dyeing their coarse cloths and stuffs red; the Nepalese are in the habit of bartering it for rock salt and borax. Kinnier and Tavernier notice the abundance of madder in Persia and Makran. Dr. G. Playfair, in a note appended to his translation of the *Talíf-i-sharífí* (*p.* 150) states that if taken to the extent of about 3 drachms several times daily, it powerfully affects the nervous system, inducing temporary delirium, &c., with evident determination to the uterine system. *R. cordifolia* is common throughout the hilly districts of India, but the Bombay market draws its supplies chiefly from Khelat through Sind, where *R. tinctorium* is cultivated.

Description.—Madder root consists of a short stock, from which numerous cylindrical roots about the size of a quill diverge; these are covered by a thin brownish suber which peels off in flakes, disclosing a red-brown bark marked by longitudinal furrows. The taste is sweetish at first, afterwards acrid and bitter.

Chemical composition.—According to Bucholz, the constituents of madder are as follows:—Resinous red colouring matter 1·2, extractive ditto 39·0, reddish brown substance soluble in alcohol 1·9, pungent extractive 0·6, gummy matter 9·0, woody fibre 22·5, matter soluble in potash 4·6, salts of lime with colouring matter 1·8, water 12·0, loss 7·4. The colouring principles of *R. tinctorium* are *purpurin* and *alizarin*, while *R. cordifolia* yields purpurin and a yellow colouring

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* Compare with Dioscorides iii., 151. περὶ ερυθροδάνου, and Pliny 19, 17; 24, 56.

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principle called by Stenhouse *munjistin*: it is to this fact that the inferiority of the latter plant as a dye-stuff is due. According to Higgins, the roots of *R. cordifolia* yield from 50 to 55 per cent. of *garancin*, which has only half the dyeing power of garancin made from *R. tinctorium*. (*Calvert, Dyeing and Calico Printing*.)

The medical action of madder, if any, is probably due to the small quantity of acrid and resinous matter contained in it. For an account of the colouring materials, which are of great importance to the dyer, Ure's *Dictionary of Arts and Manufactures* and Watts' *Dictionary of Chemistry* may be consulted.

Commerce.—Madder from Sind fetches a higher price than that grown in India; it is shipped from Kárachí to the extent of about 1,500 tons annually, and is worth about Rs. 17 per cwt., nearly double the price of Persian madder. The imports of madder (chiefly Persian) into Bombay do not exceed 7,000 cwts. annually.

VALERIANEÆ.

NARDOSTACHYS JATAMANSI, *DC.*

Fig.—*DC. Mem. Valer.* 7, *t.* 1; *Royle Ill.* 242—244, *t.* 54.

Hab.—Alpine Himalaya. The rhizome.

Vernacular.—Chhar, Balchhar, Jatamasi (*Hind.*), Jatamansi (*Beng., Mar.*), Jatamashi (*Tam.*), Jatamamshi (*Tel.*), Jatamanshi (*Can.*), Bhutkés (*Pahàriya*).

History, Uses, &c.—This plant, in Sanskrit Jatamánsi, Mansi, Bhutakesi ("demon's hair"), Pisitá, Tapasvini and Mishi, has from a very remote period been in use among the Hindus as a perfume and medicine. It is mentioned by Susruta in a prescription for epilepsy, and is prescribed by Hindu physicians as a nervine tonic and carminative, and

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aromatic adjunct in the preparation of medicinal oils and ghritas (butters). In the Nighantas it is described as cold and a remedy for leprosy, morbid heat and erysipelas. It is the *Nardin* of Dioscorides, which that writer tells us was also called *Gangitis*, because the Ganges flowed from the foot of the mountains where the plant grew.

Arabic and Persian physicians describe Jatamánsi under the name of Sumbul-i-Hindi, "Indian Spike," to distinguish it from their Sumbul-i-Rumi or Ikliti (*Valeriana celtica*), the root of which is much used in Turkey and Egypt as a perfume. The author of the *Makhzan-el-Adwiya* compares Jatamánsi root to the tail of a sable. He describes it as deobstruent and stimulant, diuretic and emmenagogue, and recommends it in various disorders of the digestive and respiratory organs, and as a nervine tonic in hysteria. He also notices the popular opinion that it promotes the growth and blackness of the hair. The dose is about 45 grains as an expectorant.

Ainslie states that the Vytians in Lower India prepare a fragrant and cooling liniment for the head * from this drug, and also prescribe it internally as a purifier of the blood. Sir W. O'Shaughnessy states as the result of his experience with jatamánsi, that it is a perfect representative for valerian. (*Bengal Disp.*, p. 404.)

When taken habitually in moderate doses, valerian improves the appetite and digestion without confining the bowels. Two drachms at a single dose may occasion a sense of heat and weight in the abdomen, eructations, and even vomiting, colic, and diarrhœa; also some excitement of the pulse, general warmth, and either perspiration or diuresis. In somewhat smaller doses its operation is chiefly restricted to the nervous

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* The hair-wash in common use among Indian women, and called Angalepan, Angodvartan, Sughandi-puri or Utnen, is composed of Gávala (seed of *Prunus Mahalib*), Kápûrkachri (*Kœmpferia Galanga*), Vála (*Andropogon muricatus*), Pách (*Pogostemon Patchouli*), Jatamansi (*Nardostachys Jatamansi*), Upalét (*Saussurea Lappa*), Nágarmoth (*Cyperus pertenuis*), Dauna (*Artemisia Sieversiana*), and Murwa (*Origanum*, several species). Other articles are sometimes added.

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system; it renders the mind tranquil, disposes to good humour and activity, produces sometimes a lively formication in the hands and feet, and a sensation about the head and spine which has been compared to the *aura epileptica*. Sometimes, on the contrary, there is a sense of embarrassment in the head, with heaviness and pain. In states of morbid nervous excitement without fever, when through exhaustion the pulse has become small and frequent, valerian lessens its frequency and increases its force and volume.

Given to rabbits in doses of from 1 to 3 drachms, valerianic acid renders the heart's action more rapid, but feebler; the respiration is hurried at first and then slower; and death usually takes place in three or four hours, preceded by prostration and convulsions. If death occurs speedily, the gastric mucous membrane is pale, but if delayed it may be congested; the kidneys are apt to be congested and the urine bloody. Oil of valerian appears to lessen the excitability of the spinal cord, and even to paralyze it, since two Cgm ($\frac{1}{3}$ gr.), injected under the skin of frog, have been found capable of preventing tetanic spasms after a like injection of 5 Mgm. ($\frac{1}{12}$ gr.) of strychnine. Given alone to these animals hypodermically, it impair mobility and sensibility. Valerianic acid, applied to the human skin, produces a white spot, followed by irritation and redness, and upon the tongue it may cause the epithelium to exfoliate.

As a medicine valerian is not a cure for *hysteria*, but it is a most valuable palliative when employed to avert or mitigate hysterical paroxysms provoked by some accidental cause. Especially is this the case in females of weak constitution and excitable temperament, and who are exhausted by care and anxiety. It is still more efficient in preventing the development of those hysteroidal attacks which weak and morbidly sensitive girls and women are liable to, and which consist in an excessive susceptibility to impressions, and in the power of converting into real sensations the suggestions of a disordered fancy, whereby countless subjective perceptions and various disordered actions

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of the lungs, heart, stomach, &c., arise. In mild cases of *mental derangement*, especially when caused by nervous shock or strain; in nervous *atony* simulating paralysis; in cases also of irregular distribution of the blood, accompanied, it may be, with indications of cerebral congestion, or, on the other hand, of cerebral anæmia, of which the chief symptoms are *vertigo*, a sense of rush of blood to the head, or fainting, confusion of sight and hearing, &c., which more than at any other time are apt to occur about the menopause,—valerian is the most promptly efficient of all the palliatives that have been used. In all those cases valerian exhibits the same potency as asafœtida, musk, and castor, and more decidedly. Oil of valerian dissolved in ether may be administered by inhalation in such attacks. Valerian is one of the best remedies for *nervous headache*, especially when it is associated with ammonia, as in the ammoniated tincture of valerian or the popular valerianate of ammonium. These preparations may be used advantageously, along with a carminative tincture, in cases of *flatulence* accompanied with palpitation of the heart. The same medicines are equally efficient in relieving *infantile colic*.

Valerian is one of the innumerable articles that from time to time have been vaunted as remedies for *epilepsy*, and, allowing for the common error of confounding epilepsy with epileptiform reflex convulsions, and even with hysteria, there can be no doubt that it has sometimes cured the disease in females and young children, and especially when it originated in fright or some analogous impression. Even in these cases it must be administered in large doses and be long continued, while other and especially hygienic measures are employed to give permanent strength to the nervous system.

Valerian is useful in the treatment of the milder forms of *delirium tremens*, especially when they follow surgical operations or injuries, and in the ataxic phenomena which belong to the *typhoid state* of fevers and inflammations. It has had some reputation as a *vermifuge* for children when associated with purgatives, such as jalap, and by enema as a remedy for ascarides of the rectum. It has also been used successfully for the relief of *dysmenorrhœa* and in *polyuria* or *diabetes insipidus.* Bouchard, however, claims that when the urine contains an excess of urea (azoturia) or of sugar (glycosuria), valerian diminishes the amount of solids discharged and thus acts as a conservator of tissue and of force. (*Stillé and Maisch.*)

Description.—The drug consists of a short portion of rhizome about as thick as the little finger, of a dark grey colour, surmounted by a bundle of fine reddish-brown fibres, the whole forming an object not unlike the tail of a sable or martin. The fibres are produced by an accumulation of the skeletons of the leaves, and are matted together, forming a kind of network; amongst them the remains of flower stalks may be found. The odour of the drug is heavy and peculiar, like a mixture of Valerian and Patchouli, the taste bitter and aromatic. When the central portion is removed and cut across, it is seen to consist of a thin cortical portion connected with the central woody column by four medullary bands, between which are situated large canals which contain the fibro-vascular bundles. The central woody column is of a red-brown colour, angular and jointed, having a certain amount of resemblance to the vertebræ in the tail of an animal.

Chemical composition.—Kemp (1884) obtained three fluid ounces of the oil from 56 lbs. of jatamánsi, and found it to have a molecular rotation of —19·5 in 100 mm., the specific gravity at 82° F. was 0·9748. One hundred pounds of the root submitted to distillation with water by Messrs. Kemp and Co. (1890), yielded fifteen ounces of a pale yellow oil of valerian-like odour, and a faintly acid distillate. A fine violet or bluish colour is produced, as with oil of valerian, by mixing a drop or two of the oil with about 20 drops of carbon bisulphide and a drop of strong nitric acid. With sulphuric acid the oil gives a reddish brown coloration. On boiling the oil acquires a darker hue and a greenish fluorescence. (*J. G. Prebble.*)

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The most important constituent of valerian root is its volatile oil. Free valerianic acid does not exist in the fresh root, but is generated from the volatile oil on exposure. The latest investigation of the oil is by Bruylants (1878), who ascertained some new facts. The hydrocarbon, $C^{10}H^{16}$, was named *borneene* by Gerhardt (1841) and *valerene* by Pierlot (1859). The *valerol* of the latter differed from Gerhardt's valerol, $C^{6}H^{10}O$, which he believed to become oxidized in contact with air to *valerianic acid*, carbonic acid being given off at the same time. Bruylants explains the generation of valerianic acid in old oil of valerian from the decomposition of $C^{10}H^{17}C^{5}H^{9}O^{2}$, which is the valerianic ether of borneol; besides this one, it contains the corresponding ethers of formic and acetic acids, the alcohol *borneol*, $C^{10}H^{18}O$, and its ether, $C^{10}H^{17}O^{2}$. Gerhardt assumed the production of borneol from the hydration of borneene. For a comparison of the chemical constitution of the root of an Indian officinal valerian with that of the European drug, the reader is referred to the next article.

VALERIANA WALLICHII, *DC.*

Fig.—*Asiat. Research. ii., p.* 405.

Hab.—Temperate Himalaya. The rootstock.

Vernacular.—Tagar (*Hind., Beng., Mar.*), Tagar-ganthoda (*Guz.*), Naudibattal (*Can.*), Mushk-i wáli, Bala (*Punjab*), Pámpe (*Bhutan*).

History, Uses, &c.—A fragrant drug called Tagara is frequently mentioned by Sanskrit writers, other names for it are Nandyávarta, Nandini, Varhini, Nahusbákhya, and Pindi-tagara. It is described in the Nighantas as sweet, emollient, pungent, hot and light; a remedy for suppresion of urine, poisons, epilepsy, swoons and headaches. Besides it medicinal uses it is an ingredient in perfumed powders, in the same manner as jatamansi. The drug appears to have attracted the

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attention of the Mahometans physicians of India, as we find it described by them as an Indian kind of Asárun (Asarabacca). The author of the *Makhzan-el-Adwiya* describes several kinds of Asárun, and says that the kind known as Tagar in India is with rice spirit given to people attacked by small-pox to lessen the eruption of pustules. Stewart notices the export of this drug to the plains of India for medicinal use. Sir William Jones (*As. Research.* II., 405,) obtained the plant and supposed it to be the source of the jatamansi root of commerce.

It appears to be the Sumbul-jibali of the Arabs and the Kishai-wála of the Persians. Recent experience has shown that this drug like jatamansi is an excellent substitute for the root of our Pharmacopœias.

Description.—The rhizomes are crooked, about two inches long and from ¼ to ½ an inch in diameter, of a dull brown colour, marked with transverse ridges, and thickly studded with circular prominent tubercules, to a few of which thick rootlets still remain attached. The crown is marked by a number of bracts; the lower end is blunt. The rhizome is very hard and tough, and the fractured surface greenish brown. The odour is like Valerian, but much more powerful.

Microscopic structure—Examined under the microscope the outer bark is seen to be composed of ten or twelve layers of compressed cells; within this is a starchy parenchyma, and next to it a cambium layer; within the cambium layer is a broken ring of vascular bundles, and lastly, a starchy parenchyma, thickly studded with conglomerate masses of large cells, having greenish-yellow contents of a resinous appearance.

Chemical composition.—An analysis of the rootstock supplied by one of us* has been made by J. Lindenberg, and the results compared with a fresh analysis of the roots of *Valeriana officinalis* made by the same chemist. (*Pharm. Zeitschr. für Russland*, 1886.)

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* Erroneously supposed at the time to be the root of *V. Hardwickii.*

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The following table shows the results—

	V. Wallich.	V. officin.
Moisture	10·46	11·57
Ash	4·04	4·31
Fat and resin, soluble in petroleum-benzine	0·56	0·36
Volatile oil and valeric acid, sol. in benzine	1·005	0·90
Volatile acid, soluble in ether	0·335	0·31
Resin and wax, soluble in ether	0·56	0·85
Resin soluble in alcohol	1·05	0·975
Tannin	3·13	1·64
Citric, tartaric and other acids	0·335	0·565
Glucose	6·03	5·32
Other substances sol. in water, insol. in alcohol	14·96	14·39
Mucilage and albumin, sol. in water	4·16	2·97
Albuminoids extracted by soda	9·72	7·83
Metarabic acid, phlobaphene and albuminoids	19·10	16·70
Starch	14·05	12·87
Cellulose	10·36	11·65
Lignin and other compounds	10·015	16·80

Commerce.—Tagar is chiefly used as a perfume in India, much as valerian was formerly in Europe. Value, Rs. 7 per Surat maund of 37½ lbs.

Valeriana Brunoniana, a variety of *V. Leschenaultii, DC.*, growing on the Nilgiris, affords a root which develops a strong odour of valeric acid when dry, and yields to distillation with water a considerable amount of volatile oil. Dr. G. Bidie has recommended it as a good substitute for European valerian.

The Indian form of **Valeriana officinalis** (*V. dubia,* Bunge), *Ledeb. Ic. Fl. Ross, t.* 350, occurs in North Cashmere, but is not known to be used medicinally by the natives.

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Royle (*Antiquity of Hindu Med.*, p. 82,) mentions the use of **V. Hardwickii**, *Wall.*, for medicinal purposes in Nepal. Wallich (*Pl. As. Rar., p.* 40), speaking of the same plant, says : "Nomen omnium specierum in Napalia, *Chamaha.*"

COMPOSITÆ.

VERNONIA ANTHELMINTICA, *Willd.*

Fig.—*Burm. Thes.* 210, *t.* 95 ; *Rheede Hort. Mal. ii., t.* 24.

Hab.—Throughout India. The fruit.

Vernacular.—Káli-jiri, Somráj, Bakchi (*Hind.*), Somráj (*Beng.*), Kadvo-jiri (*Guz.*), Káttu-shiragam (*Tam.*), Káralyé (*Mar.*), Adavi-jilakara (*Tel.*), Kadu-jirage (*Can.*).

History, Uses, &c.—The Sanskrit names of this common Indian plant are Vákuchi, Somaraji or Somarajin and Avalguja. It has long been highly esteemed as one of the principal remedies for leucoderma and psoriasis, and is also used as an anthelmintic in combination with other remedies. For administration in skin diseases Chakradatta directs the drug to be powdered along with an equal quantity of black sesamum, and a drachm of the powder to be taken in the morning with tepid water, after perspiration has been induced by exercise or exposure to the sun. The diet should consist of milk and rice. In leucoderma, a decoction of emblic myrobalans and catechu is given in addition to the powdered Vákuchi. Externally the drug is applied in skin diseases in a variety of forms, such as paste, oil, &c. Vákuchi is described in the Nighantas as sweet, pungent, digestive, bitter, alterative, astringent, cold, cardiacal, dry, antiphlegmatic ; a remedy for cough, fever, and intestinal worms. The author of the *Makhzan-el-Adwiya* describes Káli-jiri, and states that it is given internally to remove phlegm and worms from the intestines, and that a poultice or plaster of it is used to disperse cold tumors. He concludes by saying that the drug is not often prescribed internally, as it is

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thought to have injurious effects, but that it is much used as a cattle medicine. Indian Mahometan druggists sell this drug as a substitute for Átrilál (*Anthriscus Cerefolium*). Ainslie says: "The small dark-coloured and extremely bitter seeds of this annual plant are considered as powerfully anthelmintic, and are also an ingredient of a compound powder prescribed in snake-bites." Rheede states that an infusion of them is given on the Malabar Coast for coughs and against flatulency. The dose of the seed in powder, when administered in worm cases, is one pagoda weight twice daily. (*Materia Ind. II., p.* 54). According to the *Pharmacopœia of India*, the ordinary dose of the bruised seed as an anthelmintic, administered in electuary with honey, is about 1½ drachm, given in two equal doses at the interval of a few hours, and followed by an aperient; the worms are generally expelled in a lifeless state. Dr Æ. Ross speaks favourably of an infusion of the powdered seeds (in doses of from 10 to 30 grains) as a good and certain anthelmintic for ascarides. In Travancore the bruised seeds, ground up in a paste with lime juice, are largely employed as a means of destroying pediculi. Dr. Gibson, as the result of personal experience, regards them as a valuable tonic and stomachic in doses of 20 to 25 grains; diuretic properties are also assigned to them. (*Pharmacopœia of India, p.* 126.) In the Concan the following formula is in vogue as an antiperiodic—Vernonia seeds, Chiretta, Picrorhiza root, Dikamálí, Rocksalt and Ginger, p. æq. Powder, and give 6 massas in cold water, in which a red hot tile has been quenched, every morning.

Description.—The achenes are about $\frac{3}{16}$ inch long, of a dark brown colour, covered with whitish scattered hairs, cylindrical, tapering towards the base, marked with about ten paler longitudinal ridges, and crowned with a circle of short brown scales. The taste is nauseous and bitter.

Chemical composition.—The seeds, as sold in the bazars, lost 9·38 per cent. when heated to 100° C. The ash amounted to 7·7 per cent., and was free from manganese. The powdered seeds were digested with 80 per cent. alcohol, most of the alcohol distilled off, and the remainder allowed to evaporate by exposure to air. The alcoholic distillate contained no volatile principle. The alcoholic extract contained a large amount of an amber-coloured oil soluble in petroleum ether, as well as resins. By agitation of the alkaline alcoholic extract with ether, a somewhat bitter extract was obtained, which, besides containing resins, afforded evidence of the presence of an alkaloid, which gave reactions with the usual alkaloidal reagents, but which afforded no special colour reactions. We have provisionally called this principle *Vernonine.*

Commerce.—The plant is common in waste places throughout India. The country people collect the fruit and bring it for sale in the cold weather.

Value.—Rs. 3½ per Surat maund of 37½ lbs.

Vernonia cinerea, *Less.*, *Rheede Hort. Mal. x., t.* 64, a common weed throughout India in the rainy season, is considered to be the Sahadevi of Sanskrit medical writers in Northern, Southern, and Western India. In the Hindi and Marathi vernaculars it bears the Sanskrit name; in Guzerathi it is Sádeori, a modification of the same name; in Bengali Kúkseem; and in Tamil Sira-shengalunir. Under the latter name Ainslie (*Mat. Ind. II.*, 363) notices it as the Gherutti-kamma of the Telingis, used in medicine by the Hindus, in decoction, to promote perspiration in febrile affections. In the Nighantas it is described as cold, sweet, strengthening, astringent, correcting all the humors. For the numerous synonyms, and for a description of this very variable plant, we must refer the reader to the *Flora of British India.* It has no very sensible properties, and the medicinal virtues ascribed to it by the Hindus appear to us to be imaginary.

Elephantopus scaber, *Linn.*, *Wight Ic.*, *t.* 1086; *Rheede Hort. Mal. x., t.* 7, common in shady places throughout India, is the Go-jihva, "ox tongue," of Sanskrit writers, and is described in the Nighantas as cold, light, astringent, cardiacal, alterative and febrifuge; expelling bile and phlegm, and curing urethral discharges. Rheede tells us that a

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decoction of the root and leaves, with cumin and butter milk, is given on the Malabar Coast in dysuria, and in diarrhœa and dysentery. Ainslie calls it *Prickly-leaved Elephant's Foot*, and remarks that Sloane and Browne, in speaking of this plant, say, it is accounted a good vulnerary, and grows in the woods of Jamaica very plentifully; the leaves are frequently employed instead of *Carduus benedictus* amongst the inhabitants of the French West India Islands. The plant has a fibrous root; the leaves are chiefly radical and spread flat upon the ground; they are oblong, wrinkled, crenulate and very hairy; the flower stalk is branched, about a foot high, bearing a few small leaves and heads of flowers with pale purple florets. The plant is mucilaginous and astringent. The vernacular names are Gobhi (*Hind.*), Gojialata (*Beng.*), Gojibha (*Mar.*), Ana-shovadi (*Tam.*), Hakkariké (*Can.*).

Lamprachænium microcephalum, *Benth.*, is a plant of Western India called Aja-dandi and Brahma-dandi in Sanskrit, and Brahmadandi in Marathi and Canarese. It has flowers which smell like chamomile, and a branched, scabrous pubescent stem; leaves petioled, elliptic-acuminate, gradually attenuated into the petiole, pubescent above, hoary and tomentose beneath; heads of flowers small, solitary at the apex of the branches; scales of the involucre squariose, hoary and tomentose beneath, exterior ones lanceolate acuminate, bristle-pointed, ciliated; seeds smooth, shining, without ribs. The plant is used medicinally as an aromatic bitter, but is of little importance as a medicine.

Ageratum conyzoides, *Linn.*, has a strong, aromatic, and rather disagreeable smell; it has a reputation among the Hindus as an external application in agues, and is also worn as a charm against ague when dug up on Sunday with the proper ceremonies. The juice is said to be a good remedy for prolapsus ani. It is freely applied and the gut replaced. Corre and Lejanne state that the plant is used as a sudorific in Réunion under the name of *Herbe à bouc*. *A. conyzoides* is sometimes confounded by the natives with *Vernonia cinerea*, and supposed to be a kind of Sahadevi: it is the *Ageratum cordifolium* of Roxburgh, and is called Uchunti in Bengal and Osári in Western India. The plant is a common annual weed throughout India, appearing after the rains and flowering through the cold season; it is from 1 to 2 ft. in height, hispidly hairy, leaves petioled, ovate crenate, heads small, in dense terminal corymbs, bracts striate, acute, ray-florets many, pale blue or white, achenes black, pappus scales 5-awned, often serrate below. (*Fl. Br. Ind., iii.,* 243.)

EUPATORIUM AYAPANA, *Vent.*

Fig.—*Vent. Hort. Malm. t.* 3.

Hab.—America. Cultivated in India. The herb.

Vernacular.—Ayapána (*Hind., Mar., Beng.*), Ayapáni (*Tam., Tel.*), Allápa (*Guz.*).

History, Uses, &c.—Ventenat found this plant growing on the banks of the river of the Amazons; it is also a native of Cayenne; another species, *perfoliatum,* is considered as a febrifuge in America. The Ayapana has been cultivated in India for a considerable time. Ainslie says of it:—"This small shrub, which was originally brought to India from the Isle of France, is as yet but little known to the native practitioners, though, from its pleasant, sub-aromatic but peculiar smell, they believe it to possess medicinal qualities. At the Mauritius it is in great repute, and there considered as alterative and antiscorbutic; as an internal remedy it has certainly hitherto much disappointed the expectations of European physicians. An infusion of the leaves has an agreeable and somewhat spicy taste, and is a good diet drink; when fresh and bruised, they are one of the best applications I know for cleaning the face of a foul ulcer." (*Mat. Ind. II., p.* 35.) Mr. Dyer informed Ainslie that the plant was cultivated in the Island of Bourbon for the purpose of being dried and sent to France, where it was used for making a kind of tea used as a substitute for the tea of China. According to Guibourt it is now almost forgotten. (*Hist. Nat* 6^{me} *Ed.* III., 68.) In the *Pharmacopœia of India*, there is the following notice of Ayapana:—"A South American plant, naturalized in various parts of India, Java, Ceylon, &c., and generally known by its Brazilian name, Aya-pana. The whole plant is aromatic, with a slightly bitter sub-astringent taste. The exaggerated ideas of its virtues formerly entertained are now exploded; but there is reason to believe that it is a good stimulant, tonic, and diaphoretic. According to the statements of Bouton (*Med. Plants of Mauritius*, p. 96), it appears to hold a high place amongst the medicinal plants of the Mauritius, being there in daily use in the form of infusion, in dyspepsia and other affections of the bowels and lungs. In the cholera epidemics in that island in 1854-56, it was extensively used for restoring the warmth of the surface, the languid circulation, &c. As an antidote to snake-bites it has been used, both internally and externally, with alleged success. (*Madras Quart. Med. Jour., IV.*, 7.) It is not uncommon in gardens, and though not generally known, is held in considerable esteem by those who are acquainted with it. Ayapana may be compared with chamomile in its effects; it is stimulant and tonic in small doses, and laxative when taken in quantity; the hot infusion is emetic and diaphoretic, and may be given with advantage in the cold stage of ague and in the state of depression which precedes acute inflammatory affections. The infusion may be made with 1 oz. of the herb to a pint of water, and be given in 2 oz. doses every three hours.

Description.—A small shrubby plant, 5 to 6 feet high; branches straight, reddish, with a few simple scattered hairs; young shoots have a somewhat mealy appearance, due to the presence of small particles of a white balsamic exudation; leaves opposite, in pairs, their bases uniting round the stem, about 4 inches long and ¾ inch broad, fleshy, smooth, lanceolate, attenuated at the base; midrib thick and reddish; flowers like those of the groundsel, purple. The odour of the plant is aromatic, somewhat like ivy, but more agreeable; taste bitter and aromatic, peculiar.

Chemical composition.—On distillation of the fresh plant with water, a colourless oil was obtained, lighter than water, and possessing in a marked degree the odour of the plant. We also obtained a neutral principle, soluble in ether and alcohol, and crystallizing in long needles. It easily sublimed at a temperature of 159°—160° and condensed in beautiful brilliant scales and rhombic prisms. In water it was practically insoluble; it gave no reaction when dissolved in alcohol with ferric salts. In concentrated sulphuric acid it dissolved at once, with only a very faint yellow coloration. In concentrated nitric acid it dissolved immediately with production of a light yellow coloration: among the products of its oxidation by nitric acid, picric and oxalic acid were detected. With Fröhde's reagent a similar tint to that produced by sulphuric acid was yielded. We propose for this principle the name *Ayapanin.*

Eupatorium cannabinum, *Linn., Eng. Bot. V.* 6, *t.* 428, is a native of the temperate Himalaya and Europe; it is the *Herba sanctæ Kunigundis* of Tragus (*Hist.* 491, f.,) the *Hemp Agrimony* of the English, *Water-hauf* of the Germans, and *Origan aquatique* of the French. Though very common in the Himalayas, it does not appear to be used medicinally by the Hindus. The root and leaves have diuretic, and in large doses emetic properties. Boerhaave calls the herb *Rusticorum panacea,* and states that the turf-diggers in Holland use it with great benefit in jaundice, scurvy, foul ulcers, and those swellings of the feet to which they are much exposed. An infusion of 1 oz. of the dried leaves in a pint of water may be used daily; if taken hot it is a good diaphoretic. According to Righini, the leaves and flowers contain a white bitter alkaloid soluble in ether, which forms a crystalline sulphate.

In America **E. perfoliatum,** *Linn.,* and other species are used medicinally under the name of Boneset and Herbe à fièvre.

Solidago Virga-aurea, *Linn., Eng. Bot.* 301, is a native of the temperate Himalaya, Europe, and America. It is the *Golden Rod* of the English, *Verge d'or* of the French, and *Goldruthe* of the Germans. The generic name is a derivative of *solidare*, to unite, because of the vulnerary qualities of the plant, which were first brought to notice by Arnoldus de Villa Nova, who also highly extolled it as a remedy for stone in the bladder. Gerarde had a high opinion of it as an application to bleeding wounds and ulcers, and says: "I have known the dry herbe, which came from beyond the sea, sold in Bucklersbury for halfe a crowne an ounce. But since it was found in Hampstead wood, even as it were at our townes end, no man will give halfe a crowne for an hundredweight of it; which plainely setteth forth our inconstancie and sudden mutabilitie, esteeming no longer of anything how pretious soeuer it be, than whilest it is strange and rare." He further says, that "*Saracens Consound* is not inferiour to any of the wound herbes whatsoeuer, being inwardly ministred or outwardly applied in ointments or oyles."

The flowering herb has an aromatic odour and a bitterish and astringent taste; it contains a volatile oil.

In America **S. odora**, *Ait.*, is much used as a domestic remedy to produce diaphoresis, to allay colic, promote menstruation, and to cover the taste of nauseous medicines. An infusion may be prescribed, or a few drops of the essential oil.

Grangea maderaspatana, *Poir. Wight. Ic., t.*, 1097, is a common field weed throughout India, growing flat on the ground in the cold weather after the monsoon crops have been harvested. It has sinuately pinnatifid leaves, and solitary, subglobose, leaf-opposed heads of yellow flowers. The odour resembles that of worm-wood. Ainslie (*Mat. Ind. i.*, 481,) calls it *Madras Wormwood*, and says that the Tamil doctors consider it to be a valuable stomachic medicine, and also suppose it to have deobstruent and antispasmodic properties; they prescribe it in infusion and electuary in cases of obstructed menses and hysteria, and sometimes use it in preparing antiseptic and anodyne fomentations. When given internally, Grangea is usually combined with ginger, pepper, and sugar; as an antiseptic application to ulcers, the powdered leaves are used.

The vernacular names applied to this plant are properly those of Artemisia.

ERIGERON CANADENSIS, *Linn.*

Fig.—*Reich. Ic. Fl. Germ. xvi, t.* 917; *Bentl. and Trim. t.* 149. Canada Fleabane (*Eng.*), Vergerette de Canada (*Fr.*).

Hab.—Western Himalaya, Punjab, Rohilkund, Europe, North America.

Vernacular.—?

History, Uses, &c.—This genus derives its name from the Greek ηριγέρων (ἐαρι γέρων, 'aged' or 'hoary in spring'), a term used by Theophrastus for a plant which he describes (H. P. viii.) as κιχοριώδης or like Succory. Dioscorides (iv. 92) describes the same plant as having leaves like ἐυζωμον (*Eruca sativa*) but smaller, yellow flowers, and a white pappus. Pliny (25, 106) calls it Senecio. It is uncertain what this plant was, but it is generally supposed to have been a species of Senecio.

E. canadensis is common in all warm countries, but is supposed to be of American origin, and to have spread over the remainder of the globe since its importation from that continent. Parkinson, in 1640, seems to be the first author who mentions the plant, but he describes it as an American species only. It first became known to French botanists in 1653, and a few years afterwards it had become a weed about Paris; it is supposed to have been imported accidentally from Canada along with bales of skins. Shortly after this, it made its appearance in England, and is now common about London. How and by what means it reached Northern India is not known; it may possibly be a native of that region, especially as it has not made its appearance near the great commercial ports of India as we might expect from the history of its introduction into Europe.

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Several species of Erigeron are used officially as diuretics in the United States of America, and the oil of *E. canadensis* is official in the U. S. Pharmacopœia.

E. canadensis is a stimulant which owes its virtues to a volatile oil. It is popularly supposed in America to have a special action on the uterus, whence its name "Squaw-weed." Stillé states that "almost all of the testimony which has been published respecting the remedial virtues of fleabane, agree in attributing to the Canadian species, astringent and hæmostatic virtues." It has been found a useful remedy in the treatment of diarrhœa, dysentery, &c. The oil was first brought to notice by the eclectic physicians, recent trials seem to indicate that it is a remedy of special value in uterine hæmorrhage. The oil has been observed by R. Barthelow (*Physic. and Surg., April,* 1887,) to check the waste of albumen, to lessen the irritability of the bladder in cystitis, and to afford considerable relief in bronchial catarrh and similar affections. The dose given was five drops, three or four times a day.

The medicinal properties of *E. canadensis* do not appear to be known to the natives of India, nor have we heard of any vernacular name for it.

Description.—Stem 6 inches to 3 feet, simple, erect, slender, striate, with scattered hairs; branches numerous, ascending; radical leaves spathulate, or narrowly obovate, dentate, stem leaves linear-lanceolate, acute; heads very numerous, about $\frac{1}{4}$ inch long, involucre bracts acuminate, ligules pale rosy or purplish, scarcely exceeding the pappus, disk flowers yellow; achenes $\frac{1}{16}$ of an inch, narrow, flat, nearly glabrous, pappus $\frac{1}{8}$ of an inch. The plant has a mint-like odour, and an astringent somewhat bitter taste.

Chemical composition.—The plant contains a volatile oil which is a limpid, pale yellow liquid of a peculiar aroma and persistent odour, somewhat terebinthinate and of an aromatic, not very pungent taste. According to A. M. Todd (*Amer. Journ. Pharm., June,* 1887,) the specific grávity of the natural oil is not above ·865, nor below ·855; it should not boil vigorously below 342° F., nor above 347° F. until five per cent. has been volatilized; when redistilled it is colourless, and a resinous product of a deep reddish brown colour is left in the retort. The pure oil in the natural state should not polarize nearer the zero point than —26, nor further than —60; the rectified oil, freed from resin, may polarize somewhat nearer the zero point than the limit given, and the first fractions should be dextrogyre. The oil dissolves iodine without explosion, is gradually coloured reddish by potash, and is slowly acted upon in the cold by fuming nitric acid. It dissolves freely in ether and absolute alcohol, but is only moderately soluble in 80 per cent. spirit. The oil consists mainly of a terpene, $C^{10}H^{16}$, specific gravity ·8464, boiling at 176° C., and yielding a crystalline dihydrochloride which fuses at 47°—48° C. (*Beilstein and Wiegand, Ber. der Deutch. Chem. Ges. xv.*, 2854.)

Erigeron asteroides, *Roxb.*, Maredi (*Hind.*, *Guz.*), Sonsali (*Mar.*), is used in India as a stimulating diuretic in febrile affections. It is an annual, flowering during the cold season, and a native of dry cultivated lands.

Stem erect, from 6 to 12 inches high, ramous near the ground, round, hairy; branches ascending, longer than the stem; leaves alternate, the inferior ones short petioled, oval or obovate, grossly toothed, the superior ones sessile, oblong, sub-lyrate, all are covered with soft down and are somewhat glutinous; flowers few, terminal, peduncled, large, flat; hermaphrodite florets of the disc yellow, the female ones ligulate, those of the border blue, generally entire or only emarginate. (*Roxb.*)

BLUMEA BALSAMIFERA, *DC.*

Fig.—*Rumph. Amb. vi. t.* 24, *f.* 1. Oostindische ofte wilde Salie (*Dutch*).

Hab.—Tropical Himalaya, Burma, Eastern Peninsula. The camphor.

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BLUMEA DENSIFLORA, *DC.*

Fig.—*Seem. Fl. Vit.* 141, *t.* 27.

Hab.—Tropical Himalaya, Malay and Fiji Islands. The camphor.

Vernacular.—Ngai (*Chin.*), Kai-dai-bi (*Coch.-Chin.*), Sombong, Bangachappa (*Malay*), Pung-ma-theing (*Burm.*), Kukronda (*Hind.*), Kuksungh (*Beng.*). The Hindi and Bengali names are also applied to other strong smelling Blumeas.

History, Uses, &c.—The camphoraceous Blumeas are called by Sanskrit writers Kukundara and Kukkura-dru, "dog-bush" because their pungent odour is attractive to those animals; the vernacular names are derived from the Sanskrit. In addition to the two plants placed at the head of this article, *B. aromatica*, DC., and *B. lacera*, DC., are considered by the Hindus to be deobstruent and resolvent, and particularly useful in the disease of the nose called *Ahwah*, said to be peculiar to Bengal, which is accompanied by strong fever, heaviness in the head, pains in the body, especially in the neck, shoulders and loins; the powdered leaves are given internally in two drachm doses mixed with butter, and also used as a snuff. The juice of the leaves is placed in the eye to cure chronic purulent discharges; it is also used as an anthelmintic, and as an astringent in dysentery, chronic discharge from the uterus, &c. A preparation (márana) is made by oxidizing steel filings in the juice of these plants, which is highly esteemed as a remedy for renal dropsy. Dr. Anderson of Bijnor has found the fresh juice of *B. lacera* useful as an anthelmintic, especially for thread worms, and Dr Bolly Chand Sen of Calcutta speaks of it as invaluable in *Tinea tarsi*. Mir Muhammad Husain in the *Makhzan* describes *Kukronda* as a plant two cubits in height, much branched, having long crenated leaves not unlike endive leaves, but larger and softly downy, of a dark green colour, pungent odour, and astringent taste; flowers small, yellow; fruit like the anemony (downy); seeds small, black, pubescent. (*B. densiflora?*)

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The *Conyza odorata* of Rumphius is considered by Roxburgh to be *B. balsamifera*; the *Baccharis salma* of Loureiro is probably the same plant, and also the *Planta Bantamica* of Clusius (iv. 23), which was discovered by Colins in Batavia prior to the year 1619. Clusius states that it is used as a condiment and as a remedy for colic, and in paralysis as a stimulant fomentation or bath; given in decoction with the leaves of *Vitex Negundo, Careya arborea* and *Citrus acida* it produces copious perspiration. It is also used as a vermifuge and as an astringent in menorrhagia. Dr. Mason (*Burmah, its People and Natural Productions*, Lond., 1852,) mentions the manufacture of a camphor by the Tavoyers from *B. densiflora*, one of the most abundant weeds throughout the Tenasserim Provinces. Subsequently a Mr O'Riley of Amherst manufactured and purified more than 100 pounds of this camphor which was sent to Calcutta for trial, and pronounced to have the same medicinal properties as ordinary camphor. In 1874, Hanbury (*N. Repert. f. Pharm.* xxiii., 321,) pointed out that this was the Ngai camphor mentioned by Rondot (*Etude Pratique du Commerce d'Exportation de la Chine*, Paris, 1848,) which was worth 250 dollars the picul (133⅓ lbs.) in China. Mr. Hanbury also obtained from Mr. F. H. Ewer of Canton a sample of Ngai camphor, and of the plant from which it was manufactured in China (*B. balsamifera*); he also ascertained that the camphor was used in medicine by the Chinese and largely for the purpose of perfuming inks at the ink factories of Wei-chan and other places.

Description.—*B. balsamifera* is a large shrubby plant with an erect ligneous trunk, and branches covered with ash-coloured bark. Leaves alternate, short-petioled, lanceolate, irregularly serrate, and generally more or less pinnatifid at the base, downy, particularly underneath, where they are sericious and beautifully reticulated with numerous veins, from 6 to 12 inches long; petioles short, often with 1 to 4 small leaflets; corymbs terminal, numerous, bearing many sub-cylindric bright yellow flowers. (*Roxburgh.*) The plant smells strongly of wormwood and camphor.

B. densiflora very closely resembles *B. balsamifera*, and is united with it by some botanists. *B, lacera* has an erect branching stem, the principle leaves of which are petioled and lyred, the superior ones simply oval and much smaller, all are sharp toothed, downy, and various in size. Umbellets terminal, and from the exterior axils, peduncled. Flowers a dull yellow. The plant has a strong odour of wormwood and camphor.

Chemical composition.—*B. balsamifera* and *densiflora* contain a volatile oil having the odour of wormwood, and a camphor which has been examined by Sydney Plowman, 1874, who found its composition to be Carbon 77·56, Hydrogen 11·6, Oxygen 10·84, whilst Borneo camphor examined at the same time yielded C 77·66, H 11·68, O 10·66 and Laurel camphor C 78·2, H 10·44, O 11·36. Ngai camphor has the same physical properties as Borneo camphor, but the two substances differ in optical properties, an alcoholic solution of the former being *levogyre* in about the same degree that one of the latter is *dextrogyre*. By boiling nitric acid, Borneo camphor is transformed into common (*dextrogyre*) camphor, whereas Ngai camphor affords a similar yet *levogyre* camphor, in all probability identical with the stearopten of *Chrysanthemum Parthenium*, Pers. (*Hanbury Science Papers, p.* 393; *Pharmacographia.*)

Commerce.—This camphor has of late years been fraudulently sold as Borneo camphor in India. The value of Ngai camphor in China is about 250 dollars a picul, whereas Borneo camphor costs about 2,000 dollars for the first quality and 1,000 dollars for the second.

Blumea eriantha, *DC.*, a native of Western India, is called Nimurdi in Marathi, and is used by the country people to drive away fleas. It is very common in the Concan, and is remarkable for the clusters of globose, woolly buds crowded together at the crown of the root, and for the strong odour of caraways which it possesses. The habit of the plant is variable, in cultivated ground it is erect, but in pasture land prostrate or decumbent. The flowers are yellow. Medicinally the juice

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of the plant is administered as a carminative, and the herb used along with the leaves of *Vitex Negundo* and *Careya arborea* for fomentations. A warm infusion is given as a sudorific in catarrhal affections, cold it is considered to be diuretic and emmenagogue. Under the names of Bhámburdi (*Mar.*), Kalára and Chánchari-mari, "flea-killer" (*Guz.*) several kinds of Blumea are used indiscriminately by the natives of Western India. The plants generally supplied by the herbalists being *Blumea lacera*, *Laggera aurita* and *Blumea eriantha.*

In Southern India, under the names of Jangli or Divarimuli (*Dec.*), Nárak-karandai, Káttu-mallángi (*Tam.*), Káru-pogáku, Adavi-mullangi (*Tel.*), *Laggera aurita*, Schultz-Bip (*Blumea aurita*, DC.) is according to Dr. Moodin Sheriff, chiefly used. When young the foliage resembles that of a radish, the flowers are white or pinkish. Some Mahometan physicians use this plant as a substitute for Kamáfitus, the χαμαιπιτυς of the Greeks, which was *Ajuga Chamæpitys*, Schreber, a labiate plant.

Chemical composition.—The entire plant of *B. eriantha* in flower, without roots, was air-dried and reduced to fine powder.

On heating to 100° C., 8·76 per cent. was lost, due to moisture and volatile oil. The ash amounted to 8·31 per cent., it was of a light brown colour, and contained marked traces of manganese and iron.

On distillation with water a colourless oil was obtained, lighter than water, and which possessed in a marked degree the odour of the drug. The oil had a sp. gr. of ·9144 at 80° F., and was strongly levogyre. The plant yielded to petroleum ether 3·02 per cent. of extract, to ether 1·55 per cent., and to alcohol 3·40 per cent.

The various extracts contained chlorophyll, a dark acid resin, a trace of tannin, malic acid, volatile oil, and a wax, and in addition, from the ether extract a crystalline principle was obtained. This principle after repeated crystallization from alcohol was of a light lemon yellow colour, in tufts of needles, or by slow crystallization in very large rhombic prisms. It was without odour, gritty between the teeth, and without any

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decided taste. In water, cold or boiling, it was practically insoluble, it was slightly soluble in cold ether and alcohol, but was not easily soluble even in boiling alcohol. The ethereal solution left the principle, on spontaneous evaporation, as a dull adherent deposit on the sides of the vessel. The crystalline principle had a melting point of 156° C. (uncorrected); it did not contain nitrogen. With reagents it gave the following reactions:—

Concentrated sulphuric acid dissolved it, the solution being of a bright yellow colour; on the addition of water the acid became milky from separation of white flocks. Concentrated nitric acid gave an orange-red coloration; hydrochloric acid produced no change either in the cold or on heating. Fröhde's reagent gave a yellow colour, changing to yellowish-green on heating. Sulphuric acid and potassium bichromate no special reaction. An alcoholic solution gave with ferric chloride a dirty greenish brown coloration; with ferrous salts, a dirty reddish coloration, which disappeared on heating, leaving the solution of a pale yellow tint. The addition of alkalies to an alcoholic solution produced a bright yellow colour; in hot or cold aqueous alkaline solutions the principle was insoluble.

This principle would appear to be allied to the quercitrin group, but does not appear to be identical with any of those hitherto described; we reserve, however, a definite expression of opinion for the present.

PLUCHEA LANCEOLATA, *Oliv.*

Fig.—*Deless. Ic. Sel. iv., t.* 21. Syn. *Berthelotia lanceolata.*

Hab.—Upper Bengal, Oude, Punjab, Sind.

Vernacular.—Ra-sana (*Punj.*), Koura-sana (*Sind.*)

Description.—An annual, with spreading branches, and opposite, petioled, oval or oblong leaves covered with stomata on both sides, edges vertical; florets tubular, with silky pappus. It forms thickets up to four and five feet high. The leaves are

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said to be aperient, and used as a substitute for senna. We have not had an opportunity of examining them.

SPHÆRANTHUS INDICUS, *Linn.*

Fig.—*Wight Ic. t.* 1094 ; *Rheede Hort. Mal. x. t.* 43.

Hab.—Tropical Himalaya, and southwards to Ceylon. The herb.

Vernacular.—Mundi, Gorakh-mundi (*Hind., Mar., Guz.*), Murmuria (*Beng.*), Kottak-karandai (*Tam.*), Boda-tarapu (*Tel.*), Mundikasa (*Can.*).

History, Uses, &c.—This plant, which is very common in rice fields, is called in Sanskrit Munditika or Mundi, Bhikshu, Pari-vráji (mendicant) and Tapo-dhaná (rich in religious penance). It is described in the Nighantas as pungent, bitter, and stomachic; sweet, light and stimulant, a remedy for glandular swellings in the neck, urethral discharges and jaundice. The dose of the powdered herb is about a scruple or a scruple and a half twice daily, but more may be given. Rheede, who speaks of the plant under the name of *Adaca-manjen*, tells us that the powder of the root is considered stomachic, and that the bark ground and mixed with whey is a valuable remedy for piles. The plant with cumin is stomachic; with honey it is given for cough; and ground with oil, it is used to cure itch. Burmann calls it *Sphæranthus purpurea.* Forskahl speaks of it under the name of *polycephalos*, and Dr. Horsfield, in his account of Javanese medicinal plants, informs us that the inhabitants of Java consider it as a useful diuretic. (*Ainslie, Mat. Ind. II., p.* 167.) By some Indian Mahometan physicians this plant has been supposed to be the Kamázariyús* of Arabic writers, but the author of the *Makhzan-el-Adwiya* says that this is a mistake, and describes Mundi in a separate article. He speaks of it as a powerful tonic, deobstruent and alterative, and observes that the odour of the plant may be perceived in the urine and perspiration of those who are taking it. The administration of the drug is recommended in bilious affections, and for the dispersion of various kinds of tumours. The distilled water is mentioned as one of the best preparations; it is directed to be made in the same manner as rose water. Mir Muhammad Husain also states that the Hindus use the bark, and make a kind of confection of the young plant by rubbing it up with clarified butter, flour and sugar; a portion of this taken daily is said to be a good tonic, and to prevent the hair turning white or falling off. Several other somewhat similar preparations of different parts of the plant are mentioned by him, and are described as preservatives of the animal powers. An oil prepared from the root, by steeping it in water, and then boiling in oil of Sesamum until all the water is expelled, taken fasting every morning for 41 days in doses of 2 dirhems, is said to be a powerful aphrodisiac (تقویت باه بحدے بخشد کہ شرح نتوان نمود). Experiments with the distilled water show that it is not diuretic; in the case of a cachectic native suffering from frequent micturition caused by chronic prostatitis it afforded much relief. A European suffering from boils derived decided benefit from taking a wineglassful three times a-day.

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* *χαμάιδρυς* Teucrium Chamædrys, *Linn.* Petit Chéne, (Fr.) Ground Oak or Germander, considered to be tonic, diuretic and sudorific, one of the ingredients of the celebrated Portland Powder. Conf. Dios. iii. 103.

Description.—Plant generally about 8 inches high, winged; leaves thick, sessile, decurrent, obovate, bristle-serrate, covered with down, consisting of long white hairs; flower heads solitary, mostly terminal, sub-globular, the size of a small marble, purple when fresh, but lose their colour when dried; roots fibrous. The drug generally consists of the whole plant, but the capitula are sometimes sold separately. The taste is somewhat bitter, the odour of the capitula terebinthinate.

Chemical composition.—150 lbs. of the fresh herb distilled with water in the usual manner yielded a very deep sherry-coloured, viscid essential oil, very soluble in water, and clinging to the side of the vessel, so that only half an ounce could be collected. The oil does not appear to have any

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rotatory power, but it is difficult to examine on account of its opacity.

The most important principle detected in the leaves, stems and flowers of the plant was a bitter alkaloid soluble in ether, affording reactions with the ordinary alkaloidal reagents, but giving no special colour reactions. We have provisionally called this alkaloid *Sphæranthine.*

Commerce.—The dried herb, and also the dried flower heads, are sold in the bazars.

INULA HELENIUM, *Linn.*

Fig.—*Woodville Med. Bot., t.* 26; *Bentl. and Trim.* 150. Elecampane (*Eng.*), Aunée (*Fr.*).

Hab.—Central Asia, Central and Southern Europe. The root.

History, Uses, &c.—All the Indian Mahometan writers on Materia Medica mention this drug under the names of Rásan, Kust-i-shámi, or Zanjabil-i-shámi, *i.e.* Syrian Costus or Syrian ginger. Rásan is a Persian name for the plant which has been adopted by the Arabs. From the *Burhán-i-Katia* we learn that the plant is also known in Persia as Pil-gush (elephant's ear), and Gharsa, and is useful for eruptions and all kinds of pains, especially those arising from chill, bites of animals, &c. Elecampane is the ἑλένιον of the Greeks, and is described by Hippocrates as a stimulant of the brain, stomach, kidneys and uterus; it is the Inula of the Romans and the Enula campana of mediæval writers, and was formerly much used in pectoral affections, such as cough and asthma, and in acid dyspepsia, rheumatism, &c.; an ointment made with it was used to cure itch. It is still a domestic remedy in France and Germany, and to a less extent in England, and the root holds a place in the Pharmacopœias of Germany, France and the United States of America. The root is preserved as a pectoral candy on the continent of Europe, and is used in France in the preparation of absinthe. Of late years the active

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principle, *helenin*, has been introduced into medical use, and is said to possess remarkable antiseptic properties; it is recommended as a gargle in ozæna and internally in diseases of the respiratory organs for reducing inflammation. It is said to speedily relieve chronic bronchitis, and has also been employed in anthrax and acid dyspepsia. Korab claims for helenin a power of destroying bacilli (*Bull. de Therap.* ciii. 271). The dose of this principle is from $\frac{1}{6}$ to $\frac{1}{2}$ of a grain.

It is imposible to determine whether Elecampane was known to the ancient Hindus, but the old Persian name Rásan leads us to suspect that it was possibly the original Rásna of the Hindu Materia Medica, although entirely different roots are now in use under that name. It is significant that Gandhamula, *i.e.* "aromatic root," is a synonym for the rásna of the Nighantas, whilst the roots actually in use are not aromatic; the properties also attributed to these roots in the same books are those of Elecampane and not of the inert roots now in use in the plains of India.

Inula racemosa, *Hook. f.*, a native of the Western Himalayas and Cashmere, is used in veterinary medicine in those parts, as a tonic and stomachic; its roots closely resemble in properties those of *I. Helenium.*

Aitchison informs us that **I. Royleana,** *DC.*, a native of the same districts, is largely used to adulterate Costus.

Pulicaria crispa, *Benth.* (*Inula quadrifida*, Ham.), a native of the Punjab and Upper Gangetic plain, is called Phatmer or Phatmel in Hindi (फट, a rent, and मेल, union), and according to Stewart is used as a vulnerary.

Description.—The root of *I. Helenium* is about 6 inches long and 1 or 2 inches thick, divided below into branches 6 to 12 inches long and $\frac{1}{2}$ to 1 inch thick, very fleshy, in commerce always sliced either longitudinally or transversely.

The longitudinal slices have the bark overlapping; the transverse slices are concave, somewhat radially striate; externally irregularly wrinkled and brownish, internally white

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when fresh, greyish after drying, of a peculiar aromatic odour and an aromatic, bitterish, and pungent taste. The root is hygroscopic and flexible in damp weather, but when dry breaks with a short fracture. The bark is ⅛ inch or more thick, the inner portion radiates near the cambium line; the meditullium has small fibro-vascular bundles and broad medullary rays, and all parts of the root are dotted with shining yellowish-brown resin-cells.

Chemical composition.—Elecampane contains a little *volatile oil*, some acrid *resin*, *a bitter principle* not known as yet in the isolated state, *waxy matter*, *inulin*, etc. On investigating the body formerly known as helenin and elecampane camphor, which crystallizes from the concentrated tincture mixed with water, Kallen (1873) isolated *helenin*, C^6H^8O, which is insipid, almost insoluble in water, crystallizes in needles, fuses at 110° C., and is by nitric acid converted into oxalic acid and a resinous body. On distilling the root with steam, Kallen (1876) obtained *inula camphor* or *alant camphor*, $C^{10}H^{16}O$, and *inulol* or *alantol*, $C^{15}H^{20}O^2$. The first of these forms colourless needles of a faint camphoraceous odour and taste, melts at 66° C., and is sublimable and very slightly soluble in water. Alantol is a yellowish liquid having the odour of peppermint and an aromatic taste, boiling near 200° C., and yielding crystallizable alantic or inulic acid, $C^{15}H^{22}O^3$. *Inulin*, $C^{12}H^{20}O^{10}$, is contained in the subterraneous parts of Compositæ, and is obtained by forcibly expressing the grated juicy roots, when a portion will deposit on standing, and the remainder may be precipitated by alcohol. Kiliani (1881) recommends boiling the roots with water containing sodium carbonate; the liquid is cooled by a freezing mixture, and the precipitate repeatedly dissolved in hot water and reprecipitated by cooling. The autumn roots contain the largest percentage (elecampane 44 per cent.) of inulin, which by the following spring is to a considerable extent changed into mucilage, sugar, and levulin, and in some cases to glucosides. Inulin is a fine white powder, tasteless and inodorous, insoluble in alcohol, slightly soluble in cold water, more so in hot water, and then partly

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altered, but mostly reprecipitated on cooling; on the slow evaporation of its aqueous solution it may be obtained in crystalline spheres, and by hydration it is converted into gum-like and horny modifications. It appears to be the anhydride of levulose, its formula being $C^6H^{10}O^5\ {}^6H^2O$, but it does not reduce Fehling's solution. Heated with water in sealed tubes, it yields levulose; with hot baryta-water lactic acid is formed, diluted nitric acid oxidizes it to formic, oxalic, racemic, glycollic, and probably glyoxylic acids. Inulin differs from starch by the absence of concentric layers, does not yield a jelly with water, and it is coloured yellow (not blue) by iodine. (*Stillé and Maisch.*)

XANTHIUM STRUMARIUM, *Linn.*

Fig.—*Eng. Bot.* 36, *t.* 2544; *Matth. Valg.* 2, 545, *f.* Broad-leaved Burweed (*Eng.*), Lampourde (*Fr.*).

Hab.—Hotter parts of India and Ceylon. Europe. The herb.

Vernacular.—Gokhru-kallán (*Punj.*, *Sind.*), Ban-okra (*Beng.*), Marlumatta (*Tam.*), Veritel-nep (*Tel.*), Shankeshvar (*Mar.*), Shankhahuli (*Hind.*), Kadvalamara (*Can.*).

History, Uses, &c.—The ξάνθιον of Dioscorides (IV. 133,) appears to be this plant; he tells us how it should be used to dye the hair, and also notices its use in dispelling tumours. The generic name has been given it on account of its containing a yellow-colouring matter, and the specific name is an allusion to its use in scrofula. It is the *Xanthium seu Lappa minor* of Ray, Bauhin and Matthiolus. In some parts of Germany, where it is called Spitzklette, it has a popular reputation as a remedy for ague, and in Russia it is considered to be a prophylactic in hydrophobia. In the Punjab and Sind it is called *Gokhru kallán*, or ' great Gokhru, ' and is given in small-pox on the doctrine of signatures (*Stewart*); its hairs and prickles are employed in medicine in China. (*Smith.*) It appears to be the Hasak of the Eastern Arabian physicians, and the Hamaz-el-amir of the Western, it is the

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Khár-i-khasak of Persia, and Háji Zein informs us that it is called Khár-i-súhúk at Shiraz, and Harada at Ispahan; the last name is an allusion to its yellow colour, Harad is the old Persian for turmeric. Hasak is described by Mahometan writers on Materia Medica as useful for dispelling tumours and curing ophthalmia, also in renal and urinary complaints as a diuretic, and in colic; it is said to be aphrodisiac. The Hindus consider the whole plant to be diaphoretic and sedative, and very efficacious in long-standing cases of malarious fever; it is generally administered in the form of decoction, and is said to be the Shánkhini or Shankhapushpi of Sanskrit writers. Loureiro states that the seeds are attenuant and resolvent of inflammatory swellings. In America and Australia this plant has been observed to prove fatal to cattle and pigs which have pastured upon it. Modern experiments with the drug seem to indicate that like Jaborandi it is sudorific, sialogogue and slightly diuretic. The dose given has been 10 grains of the dry leaves.

Description.—Stem erect, scabrous, clouded with dark-coloured spots; leaves alternate, petioled, cordate or kidney-shaped, notched, waved, 3-nerved, scabrous, about 4 inches in diameter, petioles round, scabrous, as long as the leaves; flowers terminal and from the superior axils, male aggregate above the female, short peduncled; female, subsessile, solitary; germ superior, oblong, armed with uncinate bristles, 2-celled, each cell containing one ovule enveloped in an interior tunic.

Chemical composition.—Zander (1881) obtained from 100 parts of the fruit 5·2 ash, 38·6 fat, 36·6 albuminoids, 1·3 *xanthostrumarin* and organic acids, besides sugar, resin, &c. Xanthostrumarin seems to be a glucoside, is yellow, amorphous, soluble in water, alcohol, ether, benzol and chloroform, and yields precipitates with group reagents for alkaloids, and with ferric chloride, lead acetate, and salts of other metals, but is not precipitated by tannin or gelatin. Xanthostrumarin is related to datiscin, which is coloured yellow by alkalies, gives a green precipitate with ferric chloride, and a yellow one with

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acetate of lead. M. V. Cheatham (1884) obtained only 14·5 per cent. of fixed oil, and a principle which was precipitated by tannin. (*Amer. Journ. Pharm.*, 1881, 271, *and* 1884, 134.)

SIEGESBECKIA ORIENTALIS, *Linn.*

Fig.—*Wight Ic.*, *t.* 1103; *Schk. Han.* 3, *t.* 256. Herbe-guérit-vite (*Fr.*).

Hab.—Throughout India. Cosmopolitan in warm climates.

Vernacular.—He-kien, Kau-kau (*Chin.*), Katampam, Katampu (*Tam.*).

History, Uses, &c.—This plant is named after Dr. George Siegesbeck, a German physician, fomerly director of the gardens at Petersburgh. It appears to have been long known in China as a remedy for ague, rheumatism, and renal colic; but as far as we know, its medicinal properties are not known to the natives of India. The properties of the plant have been studied by Vinson and Louvet, who state that in the island of Réunion it has a considerable local reputation as a sialagogue, vulnerary, tonic, aperient and depurative; it is an ingredient in Périchon's *Sirop depuratif végétal,* which is used as a remedy in venereal and scrofulous affections. The juice of the fresh herb is used as a dressing for wounds, over which, as it dries, it leaves a varnish-like coating. A decoction of the leaves and young shoots is used as a lotion for ulcers and parasitic skin diseases. Other preparations of the plant are a wine and a watery extract. Auffrey of the Mauritius separated a bitter principle from the drug which he named *darutyne,* in honour of Dr. C. Daruty, the author of a work upon the medicinal plants of that Island.* J. Hutchinson (*Brit Med. Journ., June* 25, 1887,) has recommended a tincture of Siegesbeckia as a local application in certain skin diseases; he remarks that most of the medicaments now in use inconvenience the patient on account of their greasy nature, and, if not greasy, they do not afford relief to the dryness and tension of the skin. The affected parts are rubbed night and morning with a mixture of equal parts of the tincture and glycerine, which appears to act as a stimulant and parasiticide, the pain is soon relieved, and the eruptions disappear.

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* Plantes médicinales de l'île Maurice et des pays intertropicaux. Maurice : 1886. Christy, *New Commercial Plants*, No. 9, pp. 49-52.

Description.—A much branched, erect herb, 1 to 3 feet high, with opposite, broadly triangular or ovate, coarsely toothed more or less scabrous leaves. Flowers yellow, the ray-florets are strap-shaped and pistil bearing, those of the disk tubular and perfect. The exterior scales of the involucre are twice the length of the inner. The achenes are without pappus, and are half inclosed by the chaffy scales of the receptacle.

Chemical composition.—The bitter principle of this plant was discovered in 1885 by M. L. Auffray and named *Darutyne*, and a specimen of the white crystalline scales was shown in the Indian and Colonial Exhibition, London, 1886. Darutyne is prepared by treating a strong decoction of the fresh leaves with subacetate of lead to precipitate the colouring matter, the lead being removed by diluted sulphuric acid, and the filtered liquid evaporated to an extract, triturated with one-quarter of its weight of lime and dried at 144° F. It is then treated with alcohol, part of the alcohol distilled off, and the residue mixed with five or six times its volume of water, slightly acidulated. The precipitated substance after filtration is treated with alcohol, and mixed with two or three times its volume of water, when the darutyne crystallizes out, the yield being 0·15 per cent. The crystals are soluble in alcohol and ether, but insoluble in cold water, dilute acids, alkalies and chloroform and are neutral to test paper. M. Auffray finds that it does not give the reactions for glucosides, alkaloids, acids, or resin. Concentrated sulphuric acid dissolves the crystals with a brownish colour, and strong hydrochloric acid without colour in the cold, but when allowed to boil the liquid becomes of a greenish tint, depositing a green resinous substance.

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We found the crystals obtained from a decoction of the plant to give off the odour of salicylol when heated with sulphuric acid and potassium dichromate, and we obtained some crystals in the ether extract of the plant, which also acted as a derivative of salicylic acid.

Enhydra fluctans, *Lour.*, Hilamochika or Hilmochi, (*Sans.*), Hingcha (*Beng.*), Harkuch (*Hind.*), a glabrous or pubescent marsh plant of Eastern Bengal and Silhet, with sessile, linear-oblong, acute or obtuse, entire or subcrenate leaves, from one to three inches in length, and with axillary or terminal, sessile flower heads; is used as a bitter vegetable in Bengal; and is considered to be laxative and useful in diseases of the skin and nervous system. The juice of the leaves in doses of about one tola (180 grains) is also prescribed.

This plant is unknown in Western and Southern India.

ECLIPTA ALBA, *Hassk.*

Fig.—*Lam. Ill.*, *t.* 687; *Rheede, Hort. Mal. x.*, 41.

Hab.—Throughout India. The herb.

Vernacular.—Bhangra (*Hind.*), Bhengra (*Guz.*), Máka (*Mar.*), Kesuria (*Beng.*), Garaga, Kádige-garaga (*Can.*), Karesha-lánganni, Kaikeshi, Kaivishi-ilai (*Tam.*), Gunta-galijeru, Galagara-chettu, Gunta-kalagara (*Tel.*), Cajenneam (*Mal.*).

History, Uses, &c.—This is a very common weed in the rainy season, and may be found in irrigated fields and gardens at all times of the year; it is used by the Hindus at the Shraddh ceremony, being placed under and on the Pinda. It is called in Sanskrit Kesaraja, Bhringaraja and Markava, names which include *Wedelia calendulacea*, which is regarded by the natives of India as a variety of *Eclipta alba*. In the Nighantas it is described as bitter, pungent, hot, and dry, removing phlegm and wind, increasing the appetite, and curing diseases of the skin, eye and head. In practice it is principally used as a tonic and deobstruent in hepatic and splenic enlargements, and in various chronic skin diseases; in the latter class of cases it is applied externally and given internally. The juice of the plant is used in tatooing to communicate a blue colour to the punctures, and it is stated in native works that when taken internally and applied externally it will dye the hair black. Mahometan writers follow the Hindus in their description of the medicinal properties of this herb, and give Kadim-el-bint as the Arabic name. Rheede states that a decoction is used for headache and toothache, and that the juice with melted butter is given in rheumatism. Pills made by pounding the plant with oil are supposed to relieve vertigo, and remove phlegmatic humors from the brain; whilst the leaves powdered and mixed with salt, pepper and limejuice, stimulate the appetite. He describes *Wedelia calendulacea* (x., 42,) as having similar properties. According to Dutt, the last-named plant is the Kesarája mostly used in Bengal, Ainslie also mentions it under the name of *Peela Bhangra*, and describes it in the following terms :—

> "It has an herbaceous stem, a foot high, and nearly erect; leaves quite entire, opposite, lanceolate, bluntish, with yellow flowers, terminating, solitary, and on a very long peduncle. The leaves, seeds, yellow flowers, in a word the whole of this low-growing plant, which is pleasant and somewhat aromatic to the taste, is used in medicine; it is considered as deobstruent, and is prescribed in decoction, in the quantity of half a teacupful twice daily."

Mr. J. J. Wood suggested that *Eclipta alba* would be found eventually of greater service than taraxacum in hepatic derangements. The expressed juice is recommended as the best form for administration in the *Pharmacopœia of India*, and in Bombay the natives use the juice in combination with aromatics, such as ajowan seeds, as a tonic and deobstruent, and give two drops of it with eight drops of honey to new-born children seffering from catarrh. The plant is used in Madras to allay the irritation caused by scorpion sting. The leaves are rubbed from above the inflamed part down to the wound, and a paste is then made of the leaves and applied as a poultice.

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The following prescription is used in the Concan for tetanus:—Máka juice 1 tolá, juice of *Leucas zeylanica* (Tumba) ½ tolá, Ginger juice 2 tolás, juice of *Vitex trifolia* 1 tolá, leaf juice of *Sesbania grandiflora* 3 tolás; to be boiled with four times the quantity of cocoanut juice and a little rice and treacle to form a *Khir*, to be given twice a day.

Description.—*E. alba* is a small prostrate or ascending plant, stem reddish; leaves linear or oblong-lanceolate, attenuated at the base, with waved edges, 1 to 4 inches long. The whole plant is rough to the touch from the presence of numerous adpressed white hairs; the structure of these is peculiar, the base is red and turned upwards, and upon it is attached a conical, white, glandular hair. The flower heads are in pairs, axillary or terminal, ¼ to ⅓ of an inch in diameter, white or rarely yellow, one having a peduncle twice as long as the other; the receptacle is flat, and furnished with bristle-like scales between the florets, ray-florets fertile or sterile; disc-florets fertile, tubular; achenes of the ray-florets triquetrous, those of the disc compressed; pappus toothed or 2-aristate.

Wedelia calendulacea has a procumbent, glabrous or scabrid stem, 6 to 18 inches in length, rooting at the lower nodes; leaves 1 to 3 inches long, variable in breadth, sub-sessile, linear-oblong or oblanceolate, acute or obtuse, entire or sub-crenate, hairs on both sides scattered, adpressed, rigid, white. Heads solitary, yellow, on long slender axillary peduncles, 1 to 1½ inches in diameter, outer involucre bracts large, oblong-obtuse, herbaceous, much longer than the disc-florets; outer florets ligulate, central tubular; achenes of the ray triquetrous, those of the disc compressed, pappus of toothed or hairy scales.

Chemical composition.—In addition to a large amount of resin, an alkaloidal principle was detected in *E. alba*, which we failed to obtain in a crystalline form. It afforded no special colour reactions. The sulphate was slightly soluble in ether. We provisionally call this alkaloid *Ecliptine*.

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GUIZOTIA ABYSSYNICA, *Cass.*

Fig.—*Wight Ill., t.* 132; *Bot. Mag., t.* 1017. Niger seed (*Eng.*).

Hab.—Africa, cultivated in India. The seed and oil.

Vernacular.—Rámtil, Kálátil (*Hind., Beng., Mar., Guz.*), Ulisi, Valesalu (*Tel.*), Uchellu (*Tam.*), Hutchu-ellu (*Can.*)

History, Uses, &c.—This plant is the *Núk* of the Abyssinians, and was first brought to the notice of Europeans by Bruce. (*Travels*, 1768—73.) It appears to have been introduced into India by the early Arabian traders, and was first brought to the notice of the English in India in 1800, when the seeds were sent to the Botanical Garden at Calcutta from the British Resident at the Court of the Berar Raja, and from Mr. Heyne at Bangalore, as those of a plant largely cultivated for the sake of the sweet oil obtained from the seeds. (*Roxb. Fl. Ind.*, iii. 441.) In the same year *Huts' Ellu*, or the *foolish oil plant*, was observed by Dr. Buchanan in Mysore. About the middle of August, after a heavy rain, the seed is sown broadcast, and ploughed in. It requires neither manure nor weeding, and is very exhaustive to the soil. It ripens in three months, when it is cut near the root and stacked for eight days. Then, having been for two or three days exposed to the sun, the seed is beaten out with a stick, and separated from fragments of the plant by a fan. Part of it is parched and made into sweetmeats with jaggery, but the greater part is sold to the oil-makers for expression. This oil is much esteemed for culinary purposes, and is also used as a lamp oil, but is reckoned by the natives inferior to that of Sesamum. About the same time it was noticed by Ainslie, who testified to its extensive cultivation on the coast. (*Mat. Ind.*, ii. 256.) Heyne notices its cultivation in Bengal and calls it *Werinnua*. (*Tracts on India*, p. 49.) The plant is cultivated on many parts of the table-land of India as a cold weather crop, and was first shipped to London from India in 1851. Allen (*Commercial Analysis*) classifies it in the cotton seed group of fixed oils, and states that its applications are to adulterate rape oil and to act as a substitute for linseed oil. We have not found it to be siccative enough for the latter purpose, and, in fact, from its sweetness and low congealing point, we should consider it of greater value than that usually attributed to it.

Description.—This is an annual, herbaceous, erect plant; leaves opposite, long, lanceolate, coarsely serrated, peduncles elongated, subcorymbose; flowers large, bright yellow.

The achenes are of a greyish-black colour, about $\frac{2}{10}$ of an inch long, somewhat angular from lateral compression, tapering towards the base, quite smooth, taste oily and nutty.

Chemical composition.—The seeds have been examined by Anderson who found them to contain water 7·02, oil 43·22, albuminous substances 19·37, sugar, gum, &c., 13·37, cellulose 14·33, ash 3·48 per cent. The nitrogen amounted to 3·10 per cent. (*Highland Agr. Soc. Journ., New Ser., No.* 69, *p.* 376.) The oil is light yellowish brown having a specific gravity of ·921 at 20° and ·924 at 15·5°. It solidifies at a temperature below zero. A few drops mixed with strong sulphuric acid form greenish brown clots. After the application of Massie's test the oil became light brown; heated with the acid, and after the action had ceased, the oil became dark reddish brown. It required 19 per cent. of KHO for saponification, and the fatty acids resulting from the decomposition amounted to 94·9 per cent. of the oil and melted at about 21° C. The fatty acids remaining at a temperature a little above their melting-point, separated into a solid white crystalline acid melting at 50° and some liquid oleic acid. By decomposing the lead soap of the fatty acids insoluble in ether, a white lustrous body was obtained melting at 54° and solidifying at 51°, and soluble in alcohol with a slight acid reaction, probably myristic acid. The oil has slight drying properties. About one and-a-half gram of oil was heated to a temperature of 92° in a shallow capsule for a few hours each day and weighed carefully each morning before being heated. The greatest increase was observed on the second day, but the weight augmented daily in diminishing amounts until the fifteenth day, when it was found to have gained altogether 7·2 per cent. The oil was still unctuous and transparent and flowed from the vessel when inverted. The oil was heated to over 250° on three occasions, but this did not appear to affect its limpid character.

Glossocardia linearifolia, *Cass.*, *Wight Ic.*, *t.* 1110.

Syn.—*G. Bosvallea*, a plant of Central India and the Deccan, is known in Marathi by the name of *Phatar-suva*, which means *Rock anethum*. In the Poona and Sholapore districts it is called *Pitta-pápada*, a name also given to *Fumaria* as well as to several Acanthaceous plants. It is not sold in the Bombay shops, but is the Pitta-pápada of the Poona druggists, and according to Dalzell and Gibson is much used in female complaints, the nature of which they do not specify. *G. linearifolia* is a small annual, with many stems, diffuse; leaves alternate, much divided, linear at the base; heads of flowers solitary, yellow, on short naked peduncles. It has a bitter taste, and an odour of fennel, and is used as an emmenagogue.

ACHILLEA MILLEFOLIUM, *Linn.*

Fig.—*Woodville, t.* 15; *Reich. Ic. Fl. Germ., xvi. t.* 1026; *Bentl. and Trim,* 153. Yarrow, Nose-bleed (*Eng.*), Herbe aux Charpentiers, Millefeuille (*Fr.*).

Hab.—Western Himalaya. Cultivated in gardens.

Vernacular.—Biranjásif (*Ind. Bazars*).

History, Uses, &c.—Different species of Achillea have been used medicinally from a very early date, Dioscorides (iv., 34) mentions ἀχίλλειον as a plant which was used as an astringent and emmenagogue. According to Pliny the generic name was given to these plants because Achilles was the first to use them as a vulnerary, he says:—"Invenit et *achilleon* Achilles discipulus Chironis, qua vulneribus mederetur, quæ ob id

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Achilleos vocatur. Hac sanasse Telephum dicitur. Alii primum æruginem invenisse, utilissimam emplastris, ideoque depingitur ex cuspide decutiens eam gladio in vulnus Telephi. Alii utroque usum medicamento volunt. Aliqui et hanc panacen heracleon, alii sideriten. Hanc apud nos *millefolium* vocant, cubitali scapo, ramosam, minutioribusque quam fœniculi foliis vestitam ab imo. Alii fatentur quidem illam vulneribus utilem, sed veram achilleon esse scapo cœruleo pedali, sine ramis." (25,19). A species of Achillea is the *Kaisum* of the Arabians, Ibn Sina says of it:—ل رة جاليدوس زهرة ، ابلغ من الافسنتين (according to Galen its flowers are more conspicuous than those of wormwood). The same plant is the Biranjásib or Biranjásif of the Persians, which has been identified by Stocks with *A. santolina*, Linn.; the description of biranjásif in the *Tuhfat-el-muminin* is unmistakably that of an Achillea; another Persian name for the plant is *Bu-i-máderán*; it is in common use as a tonic in Persia and Sind. In Egypt a species of Achillea is used medicinally under the name of *Barbara* (بوبرا). In Europe and in the East the plants belonging to this genus have long been considered to have stimulant, tonic, emmenagogue and antihæmorrhoidal properties. *A. Moschata* (Génepi blanc) is an Alpine plant with a musky odour, having sudorific and healing properties. At Engadine, in Switzerland, a volatile oil is extracted from it called Esprit d'Iva. For administration ½ oz. of *A. millefolium* may be infused in a pint of water and reduced to 6 oz., of this 1 oz. may be given every hour. This plant has of late years been reintroduced into medical use in America; it is spoken of as a general stimulant and tonic, with peculiar relations to the pelvic organs. Like other stimulant tonics, it has been found capable of curing certain cases of intermittent fever, and is apt to promote the appetite and digestion in atonic gastric disorders. Its special local action is illustrated by the virtues ascribed to it in piles and amenorrhœa, for the cure of which it was celebrated even in ancient times. The form of the first of these diseases, in which it appears to be most efficient, is that in which, along with relaxation of the sphincter ani, there is a discharge of mucus, more or less bloody, during defecation. A similar condition of atony in the reproductive organs of the female is attended sometimes with menorrhagia, and sometimes with imperfect and painful menstruation. A tonic and stimulant regimen is essential to its successful treatment, and as a portion thereof, milfoil may sometimes be employed with advantage. By this mode of action, doubtless, milfoil has proved beneficial in leucorrhœa and flatulent colic; and it may assist in curing relaxed and otherwise inert conditions of the throat, when its infusion is used as a gargle, or in cases of sore nipples, when it is applied as a lotion. The volatile oil may be given in doses of 20 drops.

Achilleïn, in doses of from 8 to 20 grains, is reported to have occasioned a sense of epigastric oppression and some irregularity of pulse, but to have increased the appetite. (*Stillé and Maisch.*)

Description.—A perennial herb with a slender creeping root-stock, giving off numerous filiform roots, and several long subterranean, reddish stolons with a blunt succulent scale at each node. Leaves alternate, the radical ones often 6 inches long, stalked, with a wide petiole, lanceolate-oblong in outline, the cauline ones much smaller, sessile and oblong, all very deeply bi- or tri-pinnatisect with closely placed, overlapping segments, which are again cut into linear, very acute lobes, more or less hairy, mucronate, and having small oil-glands on the lower side. The flowers grow in level-topped corymbs; heads numerous, with the involucre oblong; scales imbricate, keeled; receptacle flat, chaffy; ray-florets pistillate, 4 or 5, short ligulate, white or rose-coloured; disk-florets several, perfect, tubular, with the margin whitish and the tube greenish; achenes flattened, oblong, without pappus. It has a feeble aromatic somewhat chamomile-like odour, and a bitterish, rather saline taste.

Chemical composition.—Yarrow yields by distillation with water about $\frac{1}{10}$ per cent. of a blue or dark-green volatile oil, that of the flowers having a spec. grav. of 0·92, that of the leaves ·85 to ·92, the latter being butyraceous. The bitter principle

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achilleïn was obtained by Zanon (1846) as a reddish-brown extract-like mass, and was regarded by Von Planta (1870) as being identical with the alkaloid achilleïne of *A. moschata.* Zanon's *achilleic acid* is aconitic acid (*Hlasiwetz*, 1857). Yarrow also contains a small quantity of resin, tannin, and gum, and various salts, consisting of malates, nitrates, phosphates, and chlorides of potassium and calcium; on incineration, from 13 to 17 per cent. of ash is obtained.

Von Planta-Reichenau (1870) obtained from *A. moschata* a bluish-green volatile oil, *ivaol*, of a refreshing odour and bitterish mint-like taste; *ivain*, $C^{24}H^{42}O^{5}$, soft, yellow, insoluble in water, soluble in alcohol and bitter; *achilleïne*, $C^{20}H^{38}N^{2}O^{15}$, is readily soluble in water, with difficulty in absolute alcohol, insoluble in ether, and when boiled with dilute acids yields sugar, ammonia, an odorous body, and *achilletine*, $C^{11}H^{17}NO^{4}$, which is dark-brown, insoluble in water, and not bitter; *moschatine*, $C^{21}H^{27}NO^{7}$, is insoluble in cold water, and has an aromatic bitter taste. (*Stillé and Maisch.*)

MATRICARIA CHAMOMILLA, *Linn.*

Fig.— *Lamk. Ill. t.* 678; *Bentl. and Trim. t.* 155. German Chamomile (*Eng.*), Camomille d'Allemagne (*Fr.*).

Hab.— Northern India, Persia, Europe.

Vernacular.— Bábune-ke-phúl (*Hind.*), Shimai-chámantippu (*Tam.*), Sima-chámanti-pushpamu (*Tel.*), Shima-jeventi-pushpam (*Mal.*), Shime-shyámantige (*Can.*), Bábuna-na-phúla (*Guz.*), Bábuna-cha-phúla (*Mar.*).

History, Uses, &c.—The ανθεμις of Dioscorides is referred by Sibthorp to *Anthemis chia*, Linn., but it is probable that several species were used under this name, including *Matricaria Chamomilla.* Theophrastes describes the flowers of *anthemon* as το δὲν κυκλω ανθος λευκον, το δὲν μεσω χρυσους (*H. P. vii.*, 13), his plant was therefore a single-flowered one. Formerly the chamomile flowers met with in the bazars were all obtained from Northern India and Persia, and were the flowers of *M. Cha-*

momilla, but now the double flowers of *Anthemis nobilis* imported from Europe, are found in most of the large towns. The drug does not appear to be mentioned by the old Sanskrit writers, and was probably first used in India by the Mahometan invaders. The notices of Babunah in Persian works on Materia Medica must be understood as applying to *M. Chamomilla*; we gather from them that this plant is named after the village of Bábunah in Irák-arabi, where it is particularly abundant. The Arabs call it Tuffah-el-ard and Shajrat-el-káfúr (camphor plant). It is considered to be stimulant, attenuant, and discutient. There is a popular opinion among the Persians that the odour of the flowers induces sleep and drives away noxious insects; they also say that bathing the genitals with chamomile tea has a powerful aphrodisiac effect.

Description.—The flower-heads are ½ to ¾ of an inch broad, and have a flattish involucre, with two or three rows of small oblong-linear, obtuse scales having the margin membranous. The receptacle is at first convex, but becomes strongly conical and hollow, and is free from chaff. The ray-florets are about fifteen in number, soon reflexed, white, ligulate-oblong, with two notches at the apex and enclosing the bifid style, but no stamens. The numerous yellow disk-florets are tubular, five-toothed, somewhat glandular, hermaphrodite, and have the anthers united into a tube through which the bifid style projects. The achenes are small, curved, finely five-ribbed on the inner surface, brownish, without pappus, but with a slightly elevated margin at the apex. German chamomile-flowers have a peculiar aromatic odour and a bitterish aromatic taste. They are easily distinguished from allied composite plants by their smooth, conical, and hollow disks, which shrink very considerably on drying.

Chemical composition.—German chamomile-flowers contain about ⅓ per cent. of volatile oil, some bitter extractive, malates, tannates, and a little tannin, besides the principles common to vegetables. Pattone's *anthemic acid*, isolated (1859) from *Anthemis arvensis*, Linn., was obtained by Werner (1867) from

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the officinal flowers by exhausting them with hot water acidulated with acetic acid, concentrating, precipitating with alcohol, evaporating the filtrate, and treating with chloroform. It is described as colourless silky needles having an agreeable odour of chamomile, a strongly bitter taste, and dissolving in water, alcohol, ether and chloroform. The precipitate obtained with alcohol is stated to contain a tasteless crystalline principle, *anthemidin*, which is insoluble in alcohol, ether, and chloroform, but soluble in acetic acid.

The volatile oil is a dark blue, in thin layers transparent thickish liquid, which gradually turns green and brown when exposed to light and air, and more rapidly if obtained from dried flowers; it has a strong odour of the flowers and a warm aromatic taste; dissolves in about 8 parts of 80 per cent alcohol, has the specific gravity 0·93, and seems to consist of a terpene, $C^{10}H^{16}$, associated with $C^{10}H^{18}O$. The volatile oil becomes dark-brown, or green with strong or diluted nitric acid, and deep red-brown with sulphuric acid. The blue colour is due to the presence of a volatile principle which was named *azulene* by Piesse and *cœrulein* by Gladstone (1863), and which according to both investigators, is present in all other volatile oils having a blue or green colour—in the latter associated with a yellow principle. (*Stillé and Maisch.*)

Chrysanthemum coronarium, *Linn.*, *Lam.*, *Ill. t.* 678, *f.* 6, a native of the Mediterranean region, is commonly cultivated in Indian gardens, and is a favourite flower with both Hindus and Mahometans. It blossoms in the cold season, and there are two distinct varieties, one with large flowers, and another with small. The flowers are of various colours, and when dried impress a peculiar pricking sensation on the tongue like pyrethrum. Dalzell and Gibson (*Bombay Flora ii.*, 48,) state that they are a tolerable substitute for chamomile. According to Dr. Walker (*Bombay Med. and Phys. Trans.*, 1840, *p.* 71,) the people of the Deccan administer the plant in conjunction with black pepper as a remedy for gonorrhœa. The vernacular names are, Gul-dáúdi (*Hind.*, *Beng.*, *Guz.*); Shaman-

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tippu (*Tam.*), Chemanti (*Tel.*), Jevanti-puva (*Mal.*), Shyavantigehuvu (*Can.*), Shevanti-cha-phula (*Mar.*).

Centipeda orbicularis, *Lour.*, *Wight Ic.* 1610, a native of the plains of India and Ceylon, is used as a mechanical sternutatory by the natives; it is administered to relieve headache and colds in the head like *Artemisia Ptarmica*, Linn., the sneezewort of the English. In Sanskrit it is called Chikkana or Chhikika, which is equivalent to sneezewort, and the vernacular names have a similar meaning. According to Roxburgh this plant appears during the latter part of the cold season, on cultivated land. The whole plant does not cover a space more than about 6 to 8 inches in diameter. The root is simple, the stems several, branchy, pressing on the earth; all are somewhat woolly; leaves numerous, sessile, wedge-shaped, deeply dentate, villous; flowers axillary or in the divisions of the branches, solitary, sessile, sub-globular, hermaphrodite, florets from 10 to 12 in the centre with the border 4-toothed, coloured and expanding; the female ones very numerous in the circumference, most minute, with the border seemingly 3-toothed, and the toothlets incurved. Receptacle naked.

ANACYCLUS PYRETHRUM, *DC.*

Fig.—*Woodville, t.* 20; *Reich. Ic. Fl. Germ. t.* 999; *Bentl. and Trim. t.* 151. Spanish Pellitory (*Eng.*), Salivaire d'Espagne (*Fr.*).

Hab.—North Africa. The root.

Vernacular.—Ákarkara, Akalkara (*Hind, Beng., Mar.*), Akkirakaram (*Tam.*), Ákala-karra (*Tel.*), Akkikaruka (*Mal.*), Ákalakari (*Can.*), Akarkaro (*Guz.*).

History, Uses, &c.—Pellitory root, in Sanskrit Akarákarabha, is only mentioned by the later writers, such as Sarangadhara and the author of the *Bhavaprakasa*, who have doubtless derived their knowledge of its properties from the Mahometans, who in their turn closely follow the Greeks.

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The only difficulty is that πύρεθρον is described by Dioscorides as an umbelliferous plant; but with the properties of pellitory; here the author of the *Makhzan* comes to our aid and tells us that the pyrethrum of Dioscorides resembling anethum is a drug which the Arabs call Ud-el-karih-jibbali, very common in Syria; it is found at the upper part of Wady Pardah, and, he says, I have seen its fruit; it has a root about a span in length, as thick as the finger, and has many of the properties of pyrethrum. He also quotes Antaki* as mentioning two kinds of pyrethrum, *viz.*, Western, or the kind described by Ibn Baitar, and Syrian called Ud-el-karih, which is the root of the mountain Tarkhún and the kind described by Dioscorides (*Smyrnium cordifolium*, Boiss.). We also learn from the *Makhzan* that طرخون is an Arabic form of ترخون the name of a plant common in Persia, especially in Fars and about Shiraz; it is eaten like cress and other herbs with bread and cheese. There are two kinds, wild and cultivated; it is propagated by seed and by cuttings, and has a hot, astringent and sweetish taste; if taken fasting it benumbs the tongue; on this account it is chewed to cover the taste of nauseous medicines. The taste is likened to that of the leaves of the Woodapple (*Feronia elephantum*). The root of the wild plant is called Akarkarha. Ainslie, speaking of Pellitory root, says:—"This root is to be found in most of the Indian bazars; though I cannot learn that the plant grows in any part of India. It is a native of Arabia, Syria, Calabria, Crete, and Bohemia,† and it is, no doubt, from the first-mentioned of these countries that it is brought to Hindustan, an export from Mocha. I am much inclined to think that it is the root we find noticed by Forskahl in his *Materica Medica Khairina* under the name of Ud-el-karih. With regard to its Asiatic names, there is this peculiarity, that its Arabic, Persian and Dakhanie appellations are nearly the same. The pungency of the pellitory root is not perceived till it has been chewed for a few seconds, when it occasions at first a glowing heat in the mouth soon followed by pricking sensation in the tongue and lips. The Vytians prescribe an infusion of it, in conjunction with the lesser galangal and ginger, as a cordial and stimulant in lethargic cases, in palsy, and in certain stages of typhus fever; they also order it to be chewed, as a masticatory, for the toothache. It certainly possesses powerful stimulant properties, but is scarcely ever employed in Europe as an internal remedy; though it has been found useful as a sialagogue, and as such, Dr. Thomson says, has been given with success in some kinds of headache, apoplexy, chronic ophthalmia, and rheumatic affections of the face." (*Mat. Ind.* I., 300.) Mahometan writers consider pellitory to be discutient and attenuant; they prescribe it chiefly in paralytic affections, which they suppose to be caused by phlegmatic humours. The Arabic name Akarkarha* is said to be derived from Akar and takrih, and to mean 'causing a sore.' Celsus mentions its use for opening the mouths of wounds. (*Lib. v., cap. iv.*) The Arabian physicians in the days of Avicenna prescribed pellitory in rigors. In India it is often given to parrots to make them talk.

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* Sheik Dawood of Antioch, his work is in Arabic, and has been printed at Beyrout.

† The plant alluded to by Ainslie as growing in these localities must be *Anacyclus officinarum*, Hayne, or German Pellitory. It is certainly not the Pellitory imported into India, being much smaller.

Description.—The root as found in the shops is simple, 3 to 4 inches long by $\frac{3}{8}$ to $\frac{4}{8}$ of an inch thick, cylindrical or tapering, sometimes terminated at the top by the bristly remains of leaves, and having only a few hair-like rootlets. It has a brown, rough, shrivelled-surface, is compact and brittle, the fractured surface being radiate and destitute of pith. The bark, at most 1-25th of an inch thick, adheres closely to the wood, a narrow zone of cambium intervening The woody column is traversed by large medullary rays in which, as in the barks, numerous dark resin-ducts are scattered. The root has a slight aromatic smell, and a persistent, pungent taste, excit-

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* It is also said by some to be a Coptic word, and by others supposed to be of Indian origin.

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ing a singular tingling sensation, and a remarkable flow of saliva. The drug is very liable to the attacks of insects.

Microscopic structure.—The cortical part of this root is remarkable on account of its suberous layer, which is partly made up of sclerenchyme (thick-walled cells). Balsam-ducts (oil cells) occur as well in the middle cortical layer as in the medullary rays. Most of the parenchymatous cells are loaded with inulin; pellitory, in fact, is one of those roots most abounding in that substance.

Chemical composition.—Pellitory was first analysed by Parisel, who gave the name *Pyrethrin* to a soft resin soluble in alcohol and ether. Koene subsequently found in the root a resin, brown acrid oil, yellow oil, inulin, gum, salts and a trace of tannin. The two oils and resin together were said to constitute the pyrethrin of Parisel, and the active principle has consequently been regarded as a mixed substance. C. J. S. Thompson (*Pharm. Journ.* [3], xvii. 567,) finds the active principle to be an acrid resinous substance, residing mostly in the cortical portion, and occurring to the extent of 5 per cent. in good samples of root. A very minute quantity placed on the tongue causes a strong burning sensation, which shortly increases, and remains for a considerable time, inducing a copious flow of saliva. A strong solution painted on the skin causes a sharp prickling sensation, and reddens the part where it has been applied. If the part is kept covered a blister will be produced. Besides being soluble in alcohol and ether, it dissolves in oils and acetic acid. It is composed of an acrid, brown resinous substance soluble in alcohol, but insoluble in water and strong alkaline solutions; and a dark yellow oil which is soluble in alkalies. The acridity of the oil is probably due to a small quantity of resin mixed with it.

R. Buchheim has recently claimed to have found the active principle to be a crystalline alkaloid, *Pyrethrine,* which he obtained by evaporating to dryness an alcoholic extract and exhausting the residue with ether. Pyrethrine melts at the heat of the body, and is resolved by alcoholic potash into piperidine and pyrethric acid. (*Arch. f. Experim. Path.* 5., p. 458.)

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Commerce.—The root is collected chiefly in Algeria, and is exported from Oran, and to a smaller extent from Algiers. But from information obtained by Flückiger and Hanbury from Colonel Playfair, British Consul-General for Algeria, and from Mr. Wood, British Consul at Tunis, it appears that the greater part is shipped from Tunis to Leghorn and Egypt. Mr. Wood was informed that the drug is imported from the frontier town of Tebessa in Algeria into the regency of Tunis, to the extent of 500 cantars (50,000 lbs.) per annum. Bombay imported in the year 1871—72, 740 cwts. of this drug, of which more than half was re-shipped to other ports of India. (*Pharmacographia.*) Pellitory root is valued in Bombay at about Rs. 24 per maund of 37½ lbs. The quantity imported hardly varies from year to year.

TANACETUM UMBELLIFERUM, *Boiss.*

Syn.—*Pyrethrum umbelliferum, Boiss. Fl. Or. i., p.* 352.

Hab.—Eastern Persia. The root.

Vernacular.—Mitha-akarkara, Bozidán (*Indian Bazars*).

History, Uses, &c.—This plant was found by Aitchison in the Badghis and Harirud valley. The roots are collected and sold in India as "Mitha-akarkara," "Sweet Pellitory," and are used by the Mahometan physicians as Bozidán. The latter name, as we have already mentioned (Vol. ii., p. 137), is of Persian origin, and is applied like Shakákul to several stimulating and nutritious roots mostly used by women for improving their *embonpoint*. The hakims consider it to be aphrodisiac, tonic, deobstruent, useful in rheumatism and gout, and in enlargement of the liver and spleen. They also state that it has abortifacient and anthelmintic properties.

Description.—Root 6 to 10 inches long, closely resembling that of pellitory in appearance, tapering, somewhat twisted. It has a brown, rough, shrivelled surface, is compact, and breaks with a short fracture, showing a radiate surface and small central pith. The bark adheres closely to the wood.

The drug has the faint aromatic odour of pellitory, but is almost free from pungency.

Chemical composition.—A proximate analysis of the powdered root separated, ether extract 1·0, alcoholic extract 8·6, water extract 25·1, crude fibre 56·9, and ash 6·8 parts in one hundred. The ether extract, having a distinct odour of chaulmoogra oil, was evaporated to dryness and digested in rectified spirit for several months; this separated a whitish insoluble granular fatty substance, and a light reddish brown liquid. The insoluble portion examined under a microscope was seen to consist of radiating crystalline tufts of wax, tasteless, and neutral in reaction, dissolving to some extent in boiling alcohol and solidifying in the cold; soluble in petroleum ether; it softened a little above 70°; at the temperature of boiling water it melted to a brown liquid, and with a sufficient heat, it burnt away on platinum foil with a smoky flame. The soluble portion of the ether extract was evaporated, and the fatty residue was acid in reaction, and produced a numbing sensation on the tongue and at the same time caused a flow of saliva. Petroleum ether removed a fatty acid from this residue and left a soft brown resin. This resin had the characters of pyrethrin. Besides its action on the tongue, it was soluble in ether, proof spirit, chloroform and bisulphide of carbon and insoluble in caustic and carbonated alkalies. Nitric acid decomposed it with evolution of gas. Sulphuric acid dissolved it with a red-brown colour and the mixture developed an odour of butyric acid.

The alcoholic extract of the root contained an organic acid, some saccharine matter reducing Fehling's test, but no alkaloid. The acid was deepened in colour with ferric chloride, gave an orange precipitate with plumbic acetate, but produced no deposit in solution of gelatine.

The water extract contained 15 per cent. of a carbohydrate forming a pulverulent precipitate with three volumes of alcohol.

Sweet Pellitory thus contains very little pyrethrin compared with the amount found in the Pellitory of Spain, and less inulin.

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It is more woody, and its name probably refers not so much to the amount of sugar it contains as to the small quantity of acrid and pungent principle.

SPILANTHES ACMELLA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1109. Para Cress (*Eng.*), Cresson de Para (*Fr.*).

Hab.—Throughout India. The flower heads.

Vernacular.—Pipulka (*Mar.*), Vana mugali (*Can.*). It bears the same names as *Pyrethri Radix* in the vernaculars.

History, Uses, &c.—Four forms of this plant are noticed in the *Flora of British India*,—*S. proper*, *S. calva*, *S. oleracea*, and *S. paniculata*. Of these *S. oleracea*, *Jacq. Hort. Vind ii.*, *t.* 135, is a cultivated form common in Indian gardens, and *S. paniculata* is also, in the opinion of Sir J. D. Hooker, a form produced by cultivation. The cultivated forms are chiefly remarkable for their more robust and succulent habit, and in *S. oleracea* for larger and more highly-coloured flower heads: the latter plant is the true Cresson de Para, and is supposed to have been introduced into India from Brazil by the Portuguese. The flower heads of these plants are by far the most pungent part, and are chewed by the natives to relieve toothache, which they do by producing redness of the gums and salivation. Dr. W. Farquhar has used and recommended a tincture of the flower heads for toothache in place of tincture of pyrethrum. He says it is a specific for inflammation of the periosteum of the jaws. A bit of lint dipped in the tincture and laid on the gums repeated 3 or 4 times a day has a speedy effect in reducing the pain and swelling. Graham, on the authority of Dr Lush, states that *S. oleracea* is cultivated in the Deccan as a pot-herb, and the same fact was observed by Dr. Mason in Burma. *S. Acmella proper* has been sent to us from the Western Ghauts under the Marathi name of *Pipulka* as a fish poison in general use on those hills.

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Description.—Small annual plants with round, smooth, succulent, branching stems; leaves opposite, petioled, subcordiform, subdentate. The flower heads are solitary at the end of pedicels longer than the leaves, of a conical form, and in *S. oleracea* as large as an acorn; they are entirely composed of yellow or brownish yellow hermaphrodite tubular flowers. The achenes are compressed with ciliated margins, and are surmounted, except in *S. calva*, by two naked awns. The whole plant is pungent to the taste, but the flower heads are especially so, having a hot burning taste which causes profuse salivation.

Chemical composition.—Gerrard has analysed this plant with the result that the active principle is an oleo-resin with powerfully sialagogue properties. (*Pharm. Journ. March* 8, 1884, *p.* 717.) R. Buchheim has found in the herb the crystalline alkaloid obtained by him in Pellitory root (*see* article *Anacylus Pyrethrum*). We have made a full examination of the flower heads of *Spilanthes calva*, which are used as a substitute for pellitory in some parts of India, and we find them to contain the following constituents: a resin, fixed oil, yellow colouring matter, astringent organic acid, glucose, extractive with the odour and taste of malt and 7·6 per cent of mineral matter. The resin had the reactions possessed by pyrethrin in being soluble in ether, alcohol and proof spirit, insoluble in alkalies and destroyed by oxidizing agents. In these respects it resembles the pungent principle of plants found in the *Zinziberaceæ*. We were unable to obtain it in a crystalline condition. The flower heads distilled with water afforded a distillate free from pungency, and the contents of the retort after boiling were likewise inert. The active principle is unstable in constitution and decomposed by heat.

ARTEMISIA VULGARIS, *Linn.* var. *indica.*

Fig.—*Wight Ic.*, *t.* 1112; *Rheede Hort. Mal. x.*, *t.* 45. Wormwood (*Eng.*), Armoise, Herbe de Saint-Jean (*Fr.*).

Hab.—Throughout the mountainous districts of India. The herb.

Vernacular.—Nágdoun, Mastáru (*Hind.*), Nágdoni (*Beng.*), Surband, *vulg.* Surpan (*Mar.*), Máchipatri (*Tel.*), Máchipattiri (*Tam.*), Tiru-nitripachcha (*Mal.*), Uruvalu, Urigattige (*Can.*), Nágadavano (*Guz.*).

History, Uses, &c.—There appears to be a difference of opinion as to the Sanskrit name of this plant. In Northern India and Bengal it is identified with the Nágadamani of the Nighantas, a plant which is described as a tonic and counteracting the poison of spiders and snakes. In the Deccan and Western India the Sanskrit name is said to be Indhana, although the local version of the Rája-nighanta gives Nágdavana as the Marathi equivalent of Nágadamani, a name generally applied in that language to *Crinum asiaticum*. According to Moodin Sheriff, the Sanskrit name in Southern India is Granthiparni. These names are not synonymous, and as the plant is common in all parts of the country, this discrepancy would seem to indicate that its mention by the older Sanskrit writers is very doubtful. The modern Hindus consider wormwood to be a valuable stomachic, deobstruent and antispasmodic, and prescribe it in infusion and electuary in cases of obstructed menses and hysteria. *A. vulgaris* is generally considered to be the Artemisia of the Greeks, a name generally derived from the lunar goddess Artemis, who is supposed to have been the discoverer of its virtues, but Pliny says:—"Sunt qui Artemisiam ab Artemide Ilithya cognominatam putent, quoniam privatim medeatur fœminarum malis."

Macer Floridus in his treatise, *De viribus herbarum*, calls wormwood *herbarum matrem*, and attributes to it emmenagogue, antilithic and alexipharmic properties; he also says that it assists parturition and prevents abortion. Apuleius *De virtutibus herbarum* states that a person carrying wormwood will be preserved from fatigue, hidden demons and the evil eye. "Tres artemisias," says he again, "Diana dicitur invenisse et virtutes earum et medicinam Chironi centauro tradidisse, qui primus de his herbis medicinam instituit." There is a popular superstition at Bologna that wormwood will indicate the ter-

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mination of a disease; a bunch of the leaves is surreptitiously placed under the sick person's pillow, if, after this he sleeps, he will soon get well; if not, he will die. (*De Gubernatis.*)

A. vulgaris is probably one of the kinds of Afsantin (αψίνθιον) described by Mahometan physicians, but owing to the want of a sufficient description of these drugs, it is impossible to identify it. Dr. Wight (*Ill.. ii.* 92,) notices its use in nervous and spasmodic affections, and Dr. J. L. Stewart speaks of an infusion as a good mild stomachic tonic.

Artemisia Sieversiana, *Willd.*, is one of the kinds of Afsantin sold in Indian bazars. It is imported from Persia, and has for many years been cultivated at Bandora, in the neighbourhood of Bombay, for the sake of the fresh herb, which is always obtainable in the market, and is much valued by the natives. The cultivation appears to have been in the hands of a few Christian families for several generations; they also cultivate Sweet Marjoram. The two plants are called *Azarona* and *Mazarona* by the native Christians, and were no doubt introduced into the country by the Portuguese. Medicinally it is esteemed as a tonic, deobstruent, febrifuge, and anthelmintic, and it is applied externally as a discutient and antiseptic. The hakîms prescribe it in hypochondriasis, jaundice, dropsy, gout, scurvy, &c.; also as an emmenagogue, and in hysterical affections.

Description.—*A vulgaris* is erect, suffruticose; leaves ashy and tomentose beneath, lower pinnatifid, upper trifid, uppermost undivided or with lanceolate lobes; lobes of the lower leaves toothed or cut; heads of flowers racemose-panicled, ovate; panicle leafy, spreading, partial racemes pendulous before flowering, young involucre a little tomentose, at length glabrous; exterior scales foliaceous, acute, interior membranaceous, obtuse; corol naked. (*Roxb. Fl. Ind. iii.*, 419.)

A. Sieversiana is annual or biennial, hoary-pubescent, stem erect, angled and ribbed, simple or paniculately branched above; leaves mostly petioled, broadly ovate, 2-pinnatisect, segments obtuse and obscurely lobed, hoary on both surfaces, heads ⅛ to

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nearly ½ inch in diameter, broadly hemispheric, pedicelled, secund, nodding, distant, in lax, long racemes terminating the branches, outer involucre bracts green hoary, inner broadly scarious, receptacular hairs long, straight. (*Fl. Br. Ind.*)

Chemical composition.—The Wormwoods contain absinthate of potash, a bitter substance, and a green volatile oil having a camphoraceous odour. *Absinthin* ($C^{16}H^{22}O^{5}$), the bitter principle is prepared, according to Luck, by exhausting the leaves with alcohol, evaporating to the consistence of a syrup, and agitating with ether. This ethereal solution is evaporated to dryness, and the residue treated with water containing a little ammonia, which dissolves the resin, and leaves the absinthin nearly pure. To complete the purification it is digested with weak hydrochloric acid, washed with water, dissolved in alcohol, and treated with acetate of lead, as long as a precipitate is formed. After the removal of this precipitate by filtration, the excess of lead is precipitated by sulphuretted hydrogen, and the solution is evaporated. The absinthin then remains as a hard confusedly crystalline mass, possessing an extremely bitter taste. It is but slightly soluble in water, very soluble in alcohol, and less so in ether. It possesses distinctly acid characters, and is dissolved by potash and ammonia. The *Sal Absinthicum* of the old Pharmacopœias was nothing more than carbonate of potash obtained by incineration of the plant. *Absinthol*, $C^{10}H^{16}O$, isomeric with ordinary camphor, is the essential constituent of Wormwood oil, in which it is associated with a terpene, boiling below 160°, and a deep blue oil which boils between 270° and 300°, and agrees in its properties with the blue chamomile oil examined by Kachler. Absinthol boils at 195° (*Beilstein and Kupffer*) ; at 200—205° (*Alder Wright*); 217° (*Gladstone*). It differs essentially from camphor in its chemical reactions, not being converted into camphoric acid by oxidation with nitric acid, or into camphocarboxylic acid by the action of sodium and carbonic anhydride, and yielding when fused with potash, a large quantity of resin, but no acid. Heated with phosphorus pentasulphide, it yields a considerable quantity of cymene, $C^{10}H^{14}$, identical with ordinary cymene from camphor or from cumin oil in density and the properties of the sulphonic acid derived from it. (*Alder Wright.*) Cymene is also formed, though in smaller quantity, by treating absinthol with zinc chloride.

Commerce.—Afsantin is imported from Persia; the entire plant is found in the bales, and owing to its toughness, is seldom much broken.

Value.—Rs. 5 to Rs. 7 per Surat maund of 37½ lbs.

Artemisia vulgaris is not an article of commerce.

ARTEMISIA MARITIMA, *Linn.*

Fig.—*Bentl. and Trim., t.* 157. Wormseed (*Eng.*), Semencine, Barbotine (*Fr.*).

Hab.—Northern Asia. The flower heads.

Vernacular.—Kirmáni-ajamo (*Guz.*), Kirmáni-ova (*Mar.*), Shih (*Arab.*), Kirmálá (*Hind.*).

History, Uses, &c.—The Sanskrit name of this plant is said by some to be Gadádhara, but it appears in the Nighantas under the name of Javániya "Grecian," with the Hindi synonym Kirmálá, evidently a corruption of Kirmán, the name of the province in Persia from which it is imported into India; it is described as a vermicide. *A. maritima* is the σερίφον and ἀψίνθιον θαλλασσίον of Dioscorides, and was used by the Greeks and Romans to expel intestinal worms. It was probably first known in Egypt, as Pliny states that those initiated in the mysteries of Isis used to carry a branch of it in their hands. Arabian and Persian physicians describe wormseed under the name of Shih, givign as synonyms, Sarifún and Afsantin-el-bahr; it is prescribed in doses of 2 to 3 dirhems as an anthelmintic, and also as a deobstruent and stomachic tonic. In the form of a poultice they use it to relieve the pain caused by the bites of scorpions and other venomous reptiles. The Persian name is Darmanah. The wormseed of the Indian market has been examined by Hanbury, who considers that it does not materially differ from the Russian drug, but is slightly shaggy and mixed with tomentose stalks. He states that a specimen of Artemisia, No. 3201, Herb. Griffith, Afghanistan, in the Kew Herbarium, has capitules precisely agreeing with the Bombay drug.

Santonin is now well known to the natives of India, and is largely imported from Germany. It is generally considered to act as a poison upon ascarides, but according to Dr. von Schrœder (*Arch. f. exp. Path.*, xix., 290) this is not the case. He states that the santonin does not kill these worms, but its presence being distasteful to them, causes them to leave their resting place and wander into the large intestine, from which they can then be removed by a purgative. This should determine the time for giving a purgative, and Dr. von Schrœder thinks it should either be given with the santonin, or else some hours after. We have obtained very good results by giving half the dose at bed-time, and the remaining half next morning with a dose of castor-oil.

Description.—The drug consists almost exclusively of unopened flower heads or capitules, which are so minute that it requires about 90 to make up the weight of one grain. In inferior samples, there is an admixture of stalks, and portions of a small pinnate leaf. The flower heads are of an elliptic or oblong form, about 1-10th of an inch long, greenish yellow when new, brown if long kept; they grow singly, less frequently in pairs, on short stalks, and are formed of about 18 oblong, obtuse, concave scales, closely imbricated. This involucre is much narrowed at the base in consequence of the lowermost scales being considerably shorter than the rest. The capitule is sometimes associated with a few of the upper leaves of the stem, which are short, narrow, and simple. Notwithstanding its compactness, the capitule is somewhat ridged and angular from the involucral scales having a strong central nerve or keel. The middle portion of each scale is covered with minute yellow, sessile glands, which are wanting on the transparent scarious edge. The latter is marked with extremely fine striæ, and is quite glabrous: in the young state and in the Bombay variety of the drug, the keel bears a few woolly colourless

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hairs. The florets number from 3 to 5; they have in the bud an ovoid corolla, glandular in its lower portion, a little longer than the ovary, which is destitute of pappus. Mahometan writers name several varieties of wormseed, but do not describe them with any minuteness. It would seem then that we must be prepared to meet with slight differences in packages of the commercial article, but in any case the drug should have a powerful and agreeable odour resembling cajuput oil and camphor, and a bitter aromatic taste.

Chemical composition.—Wormseed yields from 1 to 2 per cent. of essential oil, having its characteristic smell and taste. The oil is slightly levogyrate, and chiefly consists of the liquid $C^{10}H^{18}O$, accompanied by a small amount of hydrocarbon. The former has the odour of the drug, yet rather more agreeable; sp. gr. 0·913 at 20° C. It boils without decomposition at 173° to 174°, but in presence of P^2O^5 or P^2S^5 abundantly yields cymol. The latter had already been observed by Völckel (1854) under the name of *cynene* or *cinene*, yet he assigned to it the formula $C^{12}H^9$; Hirzel (1854) called it cinæbene. The water which distils over carries with it volatile acids of the fatty series, also *angelic acid.*

The substance to which the remarkable action of wormseed on the human body is due, is Santonin, $C^{15}H^{18}O^3$. It was discovered in 1830 by Kahler, an apothecary of Düsseldorf, who gave a very brief notice of it in the *Archiv. der Pharmacie* (xxxiv., 318). Immediately afterwards, Augustus Alms, a druggist's assistant at Penzlin, in the Grand Duchy of Mecklenburg-Schwerin, knowing nothing of Kahler's discovery, obtained the same substance, and named it Santonin. Alms recommended it to the medical professon, pointing out that it is the anthelmintic principle of wormseed. Santonin constitutes from 1½ to 2 per cent. of the drug, but appears to diminish in quantity very considerably as the flowers open. It is easily extracted by milk of lime, for though not an acid, and but sparingly soluble in water even at a boiling heat, it is capable of combining with bases. With lime it forms santoninate of

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calcium, which is readily soluble in water. On addition of hydrochloric acid, santoninic acid, $C^{15}H^{20}O^{4}$, separates, but parts with OH^{2}, Santonin being thus immediately reproduced.

Santonin forms crystals of the orthorhombic system melting at 170°, which are inodorous, but have a bitter taste, especially when dissolved in chloroform or alcohol. They are colourless, but when exposed to daylight, or to the blue or violet rays, but not to the other colours of the spectrum, they assume a yellow hue, and split into irregular fragments. This change, which takes place even under water, alcohol or either, is not accompanied by any chemical alteration. This behaviour of Santonin, when exposed to light, resembles that of erythrocentaurin, $C^{27}H^{24}O^{8}$. The latter has been obtained by means of ether, from the alcoholic extract of *Erythræa Centaurium*, and of some other plants of the Gentianaceæ. Mehu has shown that the colourless crystals of that substance, when exposed to sunlight, assume a brilliant red colour, without undergoing any chemical alteration. The colourless solutions of this body in chloroform or alcohol yield the original substance. Yet as to Santonin, Sestini and Cannizzaro (1876) have shown that its dilute alcoholic solution, on long exposure to sunlight, affords a compound ether of photo-santonic acid, namely, $C^{15}H^{13}O^{4}(C^{2}H^{5})^{2}$.

Wormseed contains in addition to the two bodies just described, resin, sugar, waxy fat, salts of calcium and potassium, and malic acid; when carefully selected and dried, it yielded us 6·5 per cent. of ash, rich in silica. (*Pharmacographia*, 2*nd Ed.*, *p* 389.) Wormseed oil has been investigated (1884) by Messrs. Hell, Stürcke and Ritter, and Messrs. Wallach and Brass. The latter authors confirm the statements of previous observers that the principal constituent of *oleum cinæ* is a compound having the composition $C^{10}H^{18}O$, which, as being an isomer of Borneol, they propose to call '*Cyneol*'; and that this is accompanied by a certain quantity of hydrocarbons with a similar boiling point. But they have also met with another compound richer in oxygen, and having a higher boiling point. Pure cyneol is a liquid having a characteristic but not dis-

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agreeable camphor-like odour boiling at 176° to 177° C., and having a specific gravity of 0·92297 at 16° C. It is optically inactive, though the rectified oil from which it is obtained has been found to have a rotation to the left of 2°·9, due to other constituents boiling at higher temperatures. Oxidised by boiling with nitric acid, cyneol yielded besides the lower fatty acids essentially oxalic acid, but no acid of the aromatic series; while the hydrocarbons ($C^{10}H^{16}$ and $C^{10}H^{14}$) accompanying it in the oil yielded upon oxidation always more or less toluylic or terephthalic acid. Cyneol by treatment with gaseous hydrochloric acid is converted into a hydrocarbon ($C^{10}H^{16}$), to which the name '*Cynen*' has been given.

Commerce.—Wormseed is brought to India from Afghanistan and Persia in considerable quantities. Value, Rs. 2½ to Rs. 3 per Surat maund of 37½ lbs. Santonin is now largely imported into India; much of that sold in the bazar is adulterated to the extent of three-fourths of its weight with various substances, amongst which gum and boracic acid have been noticed. An easy test is to expose it to sunlight, which turns the santonin yellow.

DORONICUM PARDALIANCHES, *Linn.*

Fig.—*Jacq. Austr.*, *t.* 350. Leopard's bane (*Eng.*), Doronic (*Fr.*).

Hab.—Europe, Syria. The rhizome.

Vernacular.—Darúnaj-i-akrabí (*Pers., Ind. bazars*).

History, Uses, &c.—*D. pardalianches*, according to Sibthorp, is called σκορπίδι in modern Greek. He identifies it with the ακονιτον of Dioscorides (iv., 75), which that writer describes as having a root like the tail of a scorpion and white like alabaster. Theophrastus (vi. 3. ix. 14) calls it θηλύφονον and σκορπίος and Pliny (25; 75) Thelyphonon and Scorpio. The author of the *Makhzan-el-Adwiya* states that Darúnaj is a scorpioid knotted root with a greyish exterior and white interior, that it is hard, faintly bitter and aromatic. He de-

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scribes the plant as having fleshy yellowish leaves of the shape of those of the almond, which lie flat upon the ground. The flower stem he says is hollow; it rises from the midst of the leaves to a height of two spans, and bears from 5 to 7 scattered leaves, thinner and longer than the lower leaves. The flower is yellow and hollow. The plant grows in Andalusia and the mountainous parts of Syria, especially about Mount Yabrúrat, where it goes by the name of Akrabi. There are two varieties of the drug, Persian and Turkish; the latter is most esteemed. With regard to its medicinal properties, he says that it is a resolvent of phlegm, adust bile, and flatulencies, cardiacal and tonic, useful in nervous depression, melancholy, and impaired digestion, also in pain of the womb, and flatulent dyspepsia.

Besides this it is prescribed for persons who have been bitten by scorpions and other venomous reptiles, and is hung up in houses to keep away the plague; pregnant women wear it round the waist suspended by a silken thread which must be made by the wearer; it is supposed to act as a charm, protecting the fœtus and procuring a painless delivery. Hung up over the bed it prevents night terrors and ensures pleasant dreams. There would appear to be a demand for it in India, as it is kept by all Mahometan druggists.

Description.—Rhizomes scorpioid, occasionally branched, flat, jointed, of a white colour, 3 to 4 inches long, ½ to ¾ inch broad, and about 2-10th of an inch thick. Upper surface scaly, under surface marked by scars of numerous rootlets, a few of which sometimes remain attached; substance brittle and horny, yellowish white, central portion somewhat spongy, odourless. Taste at first insipid, but after a few minutes a sensation of warmth and pricking is felt upon the tongue.

Microscopic structure.—Sections show that the bulk of the rhizome consists of a parenchyme, each cell of which is occupied by a mass having a granular appearance inactive in polarized light; towards the circumference, the cells become gradually smaller, and upon the surface become scaly, forming a greyish epidermis. The cells are coloured black with

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iodine with purplish centres, such as starch and dextrin would exhibit. After immersion in glycerine and alcohol, the section showed no sphæroidal crystals of inulin, but ceased to give the purplish-black colour. The vascular bundles are of a bright yellow colour, and consist of spiral vessels; they form one irregular ring round the rhizome about midway between the circumference and centre.

Chemical composition.—A decoction of the powdered rhizome gave a blue or violet black colour with iodine, but was not affected by iron salts. Water extracted 15·6 per cent. of soluble substances, consisting of 6·2 per cent. of glucose, estimated by standard potassio-cupric tartrate, and a quantity of mucilage. The marc was then boiled for two hours with hydrochloric acid (1 per cent.), an operation which rendered soluble over 60 per cent. of the drug, while 25 parts of this was glucose. Some fresh powder yielded to rectified spirit 6·75 of extract, which, with the exception of a little fatty matter, was soluble in water. This solution was sweet to the taste, abundantly reduced Fehling's solution, and was negative towards alkaloidal tests. Evaporated to dryness it was amorphous, and when heated, gave off the odour of burnt sugar. The ash was 3·3 per cent. The analysis of the drug shows it to be nutritive rather than medicinally active.

TUSSILAGO FARFARA, *Linn.*

Fig.—*Eng. Bot. vi. t.* 429; *Woodville t.* 13. Colt's-foot (*Eng.*), Pas d'âne, Taconnet, Herbe de Saint Quirin (*Fr.*).

Hab.—Western Himalaya; Persia; Europe. The herb.

Vernacular.—Fanjiun (*Arab., Ind. Bazars*); Wátpán (*Hind.*).

History, Uses, &c.—This plant is the βήχιον of the Greeks and the Tussilago and Farfarus of the Romans. From the earliest times it has been esteemed useful in coughs and other pectoral affections. Hippocrates recommends the root with honey in ulcerations of the lungs. Dioscorides, Pliny, and Galen relate that the smoke of the leaves, received into the mouth through a funnel or reed, is efficacious in coughs and dyspepsia. The Greek and Linnean names are derived respectively from βήξ and tussis which both signify "cough." Most of the Arabian and Persian medical writers describe the herb under the name of Fanjiun, or Afanjiun, an Arab corruption of ἀπογέον, a word which, as far as we know, was never applied by the Greeks to any plant. All these writers closely follow Dioscorides in their accounts of its appearance and properties. The Hindus consider that the leaves have the power of expelling *vata* or wind, which is supposed to be the cause of various disorders, especially rheumatism; whence the name Vátapána or Watpan (wind-leaf); they also use the cotton-like down of the leaf as a styptic. In Europe, colt's-foot is still officinal in France and Germany, and has a reputation in pectoral affections as a domestic remedy in England. It is smoked like tobacco and also administered internally in the form of a decoction or infusion. The flowers are one of the *quatre fleurs* of French pharmacy.

Description.—Root mucilaginous, bitterish, creeping horizontally, with many fibres. Flowers coming before the leaves (whence the old name *Filius ante patrem*), drooping in the bud, bright yellow, about an inch broad; their rays spreading, copious, very narrow; each flower on a simple, round, woolly, radical stalk, scaly with numerous reddish, smooth, scattered bracts, crowded under the flower, like an exterior calyx. Leaves erect, on furrowed, channelled foot stalks, heart-shaped, slightly lobed, copiously and sharply toothed; very smooth, and of a slightly glaucous green above, white and densely cottony, with prominent veins beneath; when young they are revolute, and thickly enveloped in cottony down. (*Smith.*)

Chemical composition.—An analysis of the leaves of this plant has been made by C. S. Bondurant. A petroleum spirit extract contained caoutchouc, resin and wax. Ether removed a bitter, colourless glucoside, and a reddish brown resin. Absolute alcohol separated 2·42 per cent. of tannic matter, and probably a little gallic acid; the extract was free from alkaloids. Water dissolved from the residue 3·42 per cent. of

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gum, and 6·23 per cent. of dextrin and allied carbohydrates, and the alcoholic filtrate from these yielded saponin. Albuminous matter, oxalate of calcium, lignin and cellulose were determined, and the total ash was 17·1 per cent. (*Phar. Jour.* [3] xviii. 77.)

SAUSSUREA LAPPA, *Clarke.*

Fig.—*Dcne. in Jacq. Voy. Bot., t.* 104. Arabian Costus.

Hab.—Cashmere. The root.

Vernacular.—Kut (*Hind.*), Páchak (*Beng.*), Upalét (*Guz.*), Kushta (*Mar.*), Koshta (*Can.*), Goshtam (*Tam.*), Goshtamu (*Tel.*).

History, Uses, &c.—Sanskrit writers on Materia Medica mention a fabulous root under the name of Pushkaramula, "Lotus root," and ascribe to it properties similar to those of Costus. Among many other synonyms it bears the name Kashmira, "coming from Cashmere." We think there can be little doubt that this root, which is not now obtainable, and is described in the Nighantas as hot, bitter and pungent, and useful in cough, asthma, fever, dyspepsia and skin diseases, must have been Orris root. Kushta or Costus is now used instead of it, and orris root, although much used in India by the Mahometans, has not been identified by the modern Hindus with Pushkaramula. Κόστος* is mentioned by Theophrastus (H. P., ix. 7), Dioscorides (i. 15), and is among the offerings made, B.C. 243, by Seleucus II., King of Syria, and his brother, Antiochus Hierax, to the temple of Apollo at Miletus. Costus, like many other Indian drugs and spices, was formerly carried to Europe by the Arabs, and, being supposed to be a production of Arabia, was known to the ancients as Arabian Costus. Dioscorides says:—"The best is that which is fresh, light coloured, compact and of firm texture, dry, not worm-eaten, devoid of an acrid smell, and which tastes hot and biting." He also mentions an inferior kind, light like Ferula, which he calls Indian Costus. The Syrian Costus of the same writer is Elecampane root. The Arabs appear to have had, like the Hindus, a fabulous kind of Costus, which they speak of as the carrot of the sea (جزر البحر) or Costus of the sea (قسط البحر), which is mentioned in a tradition as one of the best of remedies.

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* The Greek name is derived from the Sanskrit कुष्ठ through the Arabic قسط

This myth probably led the Greeks to describe Arabian as distinct from Indian Costus. Arabian writers describe Costus as a wood brought from India, a well known drug, of sweet odour, with which women and infants are fumigated: it is diuretic, beneficial to the liver in a high degree, and for the colic, and for worms, and the quartan fever, as a beverage; and for rheum, and defluxions, and pestilence, when the patient is fumigated therewith; and for the leprous-like disorder called بهق, and the discoloration of the face termed كلف, when applied as a liniment; and it confines the bowels, expels wind, strengthens the stomach and heart, occasions pleasurable sensation, is an ingredient in many sorts of perfume, and is the best of perfumes in odour when one fumigates therewith (*El. Leyth*, "*Eyn*"; *Kámus*; *Taj-el-Arús*). Persian physicians copy all that the Greeks and Arabs have written, although they evidently know there is only one kind of Costus, and that brought from Cashmere. For an account of the history of this drug in mediæval Europe, Cooke (*Phar. Jour., July* 21*st*, 1877,) and Flückiger (*Phar. Jour., Aug.* 18*th*, 1877,) may be consulted. Amongst European writers upon the Materia Medica of India, Ainslie, although he describes Kust as the root of *Costus arabicus*, expresses his doubts in the following words: "Judging from the root, the plant would appear to differ from that described in the 11th Vol. of the *Asiatic Researches*, p. 349." The credit of first suggesting the botanical source of the drug is due to Guibourt; his conjectures were afterwards confirmed by Falconer, who, when on a visit to Cashmere, discovered that an *Aplotaxis* growing there produced the commercial Kust. The plant itself had been previously described by Jacquemont in 1831. Falconer's description may be found in the Transactions of the Linnean Society (1845, *Vol.* XIX., *p.* 23). There is also a full account of the drug and plant, with woodcuts, in

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Guibourt's History of Drugs (Vol III., 1869, p. 32, *et seq.*). Dr. Falconer maintained that the Aplotaxis was the Costus of the ancients; after giving his reasons for holding this opinion, he remarks:—

"It is collected in large quantities and exported to the Punjab, whence the larger portion goes down to Bombay, where it is shipped for the Red Sea, the Persian Gulf, and China; a portion of it finds its way across the Sutlej and Jumna into Hindustan Proper, whence it is taken to Calcutta, and bought up there with avidity, under the designation of Patchak, for the China market."

Royle, who wrote before Falconer's discovery of the source of Kust, appears to have met with two kinds of Costus, Kust-i-talkh and Kust-i-shírín; from his observations on the latter article it would seem to have been the Kust of commerce. (*Illustrations, p.* 360.) Dr. Royle's original specimen of Kust-i-talkh has also been examined and found to be the root of *Aplotaxis.* At the present day we meet with only one kind of Costus in commerce. Cooke suggests that Kust-i-shírín is probably the young and Kust-i-talkh the old root, but no distinction of the kind is known in Bombay, and Haji Zein-el-Attar, the author of the *Ikhtiárát* (A.D. 1368) states that Kust-i-talkh is a Persian name for Indian Costus. Kust-i-shírín is the Kust-el-halu of the Arabs and our Orris root.

With regard to the uses of Costus, Dr. Irving states that formerly, when opium was not produced in Rajwarra, this root was extensively smoked as a stimulant. He adds that it is said to be narcotic when thus used, and that formerly great quantities went to China for smoking purposes. At the present time it is chiefly used as a perfume, and to protect bales of cloth from insects. In the Punjab it is applied in powder to ulcers, for worms in wounds, &c., and for toothache; it is also given in rheumatism. A summary of the uses of this drug is given by Baden Powell in his *Punjab Products* in the following terms:—

"1*st*—Dried and powdered as the principal ingredient in an astringent stimulant ointment, applied to severe ulcerations.

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2nd—Dried and powdered as a hair wash.

3rd—As a stimulant in cholera; an infusion is made of Cardamoms 1 dr.; fresh 'Kut' 3 drs.; Water 4 ozs. One ounce every half hour. It is doubtless a powerful aromatic stimulant, and would be serviceable in any spasmodic disease.

4th—It is universally employed by the shawl merchants as a protector of Cashmere fabrics from the attacks of moth and other vermin.

5th—The dried root is an agreeable fumigatory, and yields excellent pastilles, which burn fairly.

6th—It is exported in enormous quantities to China, where it is used as an incense. In every Hong it is found; no mandarin will give an audience until the 'patchak' incense smokes before him; in every Joss-house it smoulders before the Tri-budh deity; in every floating junk in the Chinese rivers, the only house of countless hordes, Budh's image is found, and the smoke of the Patchak religiously wends its way heavenward. As to its uses in China, Dr. Porter Smith says that it is used in making incense in the South, or to preserve clothes from the attacks of moths and other insects. It is said to have the power of turning grey hair black. Carminative, stimulant, antiseptic, prophylactic, astringent, sedative, and insecticidal properties are referred to this remedy. The Chinese apply it with musk, which it resembles in odour and properties, to aching teeth."

Description.—Costus occurs in crooked twisted pieces about 3 inches long, and from ½ to 1½ inch in diameter, almost always split. Externally it is brown, marked by longitudinal ridges, and has a rough and somewhat reticulated surface. Its substance is compact and brittle, the fractured surface having a resinous appearance and dirty white colour. The central portion is generally absent, and appears to have been removed by decay before the root was collected. The taste is bitter, pungent and camphoraceous; the odour resembles that of fresh violets or orris root.

Microscopic structure.—Flückiger in his pamphlet, "*Die Frankfurter Liste,*" Halle, 1873, p. 25, has shown that the root abounds in inulin, and shows, especially in the bark of the branches of the root, large balsam ducts. In both these respects Costus root agrees well with Elecampane and other aromatic roots of the Compositæ. A microscopic examination shows that the root consists of two parts, *viz.*, a thick cortical layer of close texture, pervaded by a few laticiferous ducts and an inner radiating portion, the parenchyma of which is not so dense. This is also provided with laticiferous ducts, and a very abundant scalariform vascular system, which appears to be loaded with resinous matter. We have not been able to detect any starch, nor does the iodine test indicate its presence.

Adulteration.—The natives of Cashmere say that this drug is apt to be adulterated with five or six other kinds of roots. A sample of false Costus in the Indian Museum, under the name of *Kút mitha*, examined by Cooke, was found to consist of pieces of a cylindrical root from 1 to 3 inches in length and from $\frac{1}{2}$ to $1\frac{1}{2}$ inch in thickness; externally it was nearly smooth, or longitudinally striate with transverse paler scars. It was much lighter and less compact than Costus, friable and farinaceous internally, very much subject to attacks from insects, with little or no apparent odour or taste, and containing a large quantity of starch, the granules of which were variable in size, and attached to each other in twos and threes. In 1859, a communication was made to the Agri-Horticultural Society of India of two roots, one called Kút and the other Thúth. They were from the hills of that part of the Kangra district which borders on Chumba. The "Kút" was identified as the "Costus," and the other was believed by Dr. Thompson to be the root of *Salvia lanata*, which was said to be common also in Cashmere, where it is used to adulterate "Kút." Subsequently Mr. H. Cope of Umritsar contributed some remarks to the same Society on the adulterations of this drug. "This adulteration," he says, "is now (1860) carried to such a pitch with the assistance not only of the tut (which so closely resembles the genuine article in every respect but its qualities, that it is difficult to distinguish the one from the other after admixture, which imparts to the false the odour of the true drug), but with other foreign substances of which cowdung is one, that I have ascertained as a fact that the more unscrupulous dealers use some 20 seers of the Kút to flavour 100 seers of trash. When tut was first found useful as an admixture, it was sold at Re. 1½ per maund; being now the main ingredient of the Patchak of commerce, it has risen to Rs. 4½. I am told that two other substances, resembling the genuine article in exterior appearance, have been ascertained to serve as ingredients in the mixture sent to Calcutta and Bombay for exportation to China under the name of Patchak. They are, a root called Chog, brought from the hills, which is generally reported to be a deleterious drug, and Nirbisí, the root of a species of Aconitum, probably a virulent poison." (*Cooke in Phar. Jour., July 21st,* 1877.) With regard to Mr. Cope's remarks, we may mention that there is no difficulty in obtaining genuine parcels of Costus in Bombay. Perhaps the adulterated article may be specially prepared for the China market.

Chemical composition.—The air-dried roots reduced to powder, after heating for 26 hours to 100°C., lost 13·70 per cent. in weight, and were practically free from odour. The ash amounted to 3·46 per cent., and contained manganese in marked amount.

The odorous principle of the drug appears to consist of two liquid resins, both soluble in ether, alcohol, and benzene. One is neutral in reaction, and possesses in a very marked degree the odour* of the drug: the taste is somewhat camphoraceous: it is liquid at ordinary temperatures, amber-coloured, and after standing for some time gives an indistinctly crystalline deposit. It is apparently unaltered by agitation with dilute caustic alkaline solutions; and may be distilled without any alteration in odour. With concentrated sulphuric acid it first affords a deep brownish yellow coloration, changing to rich carmine on standing. The other resin is also liquid, amber-coloured, and possesses a musty odour, and gives an indistinctly crystalline

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* A mixture of musk and orris root.

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deposit on standing: the taste is pungent. It is also easily soluble in ether, alcohol, and benzene, and the alcoholic solution is strongly acid in reaction; with alkalies it combines, and on the addition of acids is precipitated as a milky white deposit. With concentrated sulphuric acid it affords a similar reaction to that of the first described resin.

In addition to these resins, evidence of an alkaloid was also obtained, together with traces of an ethereal salt of valeric acid, and an astringent principle giving a dark brownish coloration with ferric salts: and a dark solid resin soluble in amylic alcohol, but insoluble in ether or benzene.

Commerce.—The roots are dug up in the months of September and October, when the plant begins to be torpid; they are chopped up into pieces from 2 to 6 inches long, and exported without further preparation. The quantity collected is very large, amounting, as far as Dr. Falconer could learn, to 10,000 or 12,000 *khurwars* (load of 192 lbs.). The commodity is laden on bullocks, and exported to the Punjab, whence it finds its way to Bombay, and a portion to Calcutta through India. In Dr. Falconer's time the cost of collection and transport was about half a crown per cwt. Cleghorn states that it is also exported from Pangi on the Upper Chenab to the plains. The loads of it when passing, scent the air to some distance. Davies' "Trade Report" gives 20 maunds as exported to Afghanistan *via* the Bolan. Royle mentions that in one year (1837-38) 6,697 maunds of this root, valued at Rs. 99,000, were exported from Calcutta to China, and in 1867-68 nearly 10,000 maunds. In Cashmere the Maharaja is said to take it over from the collectors at half the price at which it sells again. In 1864, his income from this source was put down on good authority (according to Dr. Stewart) at 300,000 chilki, equal to nearly 1,90,000 rupees; but this, he adds, is scarcely credible.* Kút is imported into Leh in small quantities from Cashmere for exportation to Lhassa, where it is called, as well as by the

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* In the last official Reports, the export of Chob-i-koot to the Punjab are valued at Rs. 16,000 only, but under the head of drugs, &c., there are exports valued at Rs. 1,00,000, part of which may possibly be Costus.

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Bhotes, *Rusta*, and is used for incense. In 1871, 33 maunds were imported into Leh from Cashmere, valued at Rs. 692. According to Dr. Falconer, at the time he wrote, the cost of collection and transport to a depôt at Cashmere was 2*s.* 4*d.* per cwt.: on entering India its value was enhanced to from 16*s.* 9*d.* to 23*s.* 9*d.* per cwt., whilst the commercial value at Canton was 47*s.* 5*d.* per cwt. From the Consular reports, it appears that in the year 1875 the imports of Costus into two Chinese ports only were for Hankow 1,270 piculs, valued at £5,224 6*s.* 3*d*, and Cheefoo 277 piculs, valued at £1,197, so that it is clearly no insignificant article of Chinese commerce. (*Cooke in Phar. Jour., July* 21*st*, 1877.) The value of Costus in Bombay averages Rs. 10 per maund of 37½ lbs.

CENTAUREA BEHEN, *Linn.*

Hab.— Persia, Syria, Armenia. The root.

Vernacular.—Sufed Bahman (*Pers., Indian Bazars*).

History, Uses, &c.—This root is the White Behen and white Rhapontic of European writers on Materia Medica and the Bahman abiad of the Arabians.

White and red Bahman were drugs of the ancient Persians, through whom the Arabs became acquainted with them, and introduced them into the West. From the Burhán-i-Kátia we learn that the word Bahman is equivalent to Brahman, and means the supreme intelligence; it is also the name of one of the Persian months, of the second day of each month, and of a plant which flowers in the month Bahman (January). Of this plant there are two varieties, red and white, the roots of which are fattening, expel flatulence, and are aphrodisiacal.

On the second day of the month Bahman, when the name of the day and month are the same, the Persians used to celebrate a feast, and cook all kinds of corn and meat, and sprinkle the flowers of the red and white Bahman upon the food; they also made a flour of the two roots and ate it with sugar, and the white Bahman they powdered and drank with milk to strengthen the memory. This day, which was called the *Bahmanjana*, was

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considered to be a propitious day for collecting medicinal herbs, commencing any undertaking, putting on new clothes, paring the nails, cutting the hair, &c.

Bahman-i-sufed is much used by Mahometan physicians, who consider it to be hot and dry in the second degree and a powerful aphrodisiac and resolvent of phlegmatic humours; they also prescribe it in calculous affections and jaundice. Ainslie (*Mat. Ind.* ii., 14) confounds it with Asgandh, the root of *Withania somnifera*. The dose is one dirhem. Red Bahman or Red Rhapontic, although a root of an entirely different structure, is always associated with white rhapontic in the East; its source is uncertain. The author of the *Makhzan el-Adwiya* states that it is the root of a plant called by some Kaf-i-Adam.

Description.—*White Bahman.*—The dry root is of a whitish-brown externally, much shrivelled and twisted; near the crown it is marked by numerous circular lines. It may be either simple and tapering, or more or less branched; sometimes a portion of purplish stem remains attached; the average length is about 2½ inches, diameter ¾ of an inch; the interior is white and spongy; when soaked in water it swells and becomes mucilaginous. The taste is mucilaginous and slightly bitter. Microscopic examination shows a mass of regular parenchyma surrounded on the outside by the brown oblong cells of the cortex. The centre of each of the parenchymatous cells is occupied by a substance giving a transient blue-black colour with iodine. There are numerous bundles of spiral vessels.

Red Bahman is a tuberous root, consisting of a central portion about 2 inches in diameter, from which spring 5 or 6 tapering tubers from 1½ to 2 inches long, and from ½ to 1 inch in diameter at the base. At the top of the central tuber is a scaly crown about 1 inch in diameter. The external surface of the root is of a reddish-brown colour, scabrous and marked by numerous circular and longitudinal wrinkles; internally there is a dull red woody central portion, surrounded by a thick, yellowish-white horny layer, which near the crown becomes spongy. In the commercial article the root is sliced and the central woody part removed. A section of the lateral tubers shows a red woody core, from which radiate rows of red spots as far as the inner bark. The spots when magnified are seen to consist of bundles of scalariform vessels, surrounded by a collection of pigment cells; the medullary rays connect these bundles, and are composed of single rows of oblong cells filled with finely granular red pigment. The bulk of the tuber consists of transparent cells which contain no starch. The bark is composed of an outer layer of epidermal scales, a middle layer of tangentially extended cells loaded with red pigment, and an inner layer of closely-packed columns of cells containing finely granular matter, and sometimes red pigment. The root has a mucilaginous and somewhat astringent taste. In general appearance and minute structure it closely resembles that of the Pæony, and it is worthy of note that an edible Pæony (*P. albiflora*, Pall.,) is known to grow in Central Asia.*

Chemical composition.—The different nature of these two drugs is substantiated by comparing the results of their proximate analysis, and by their affording entirely different constituents.

	White Behen.	Red Behen.
Ether extract..............	1·6	0·6
Alcoholic ,, ...	4·6	9·9
Aqueous ,, ...	13·9	35·3
Organic residue...........	57·5	34·9
Moisture....................	16·2	12·1
Ash..........................	4·6	5·9
Undetermined	1·6	1·3
	100·0	100·0

White Behen yields to ether a yellow oily liquid, imparting a persistent greasy stain to bibulous paper, soluble in rectified spirit with an acid reaction, crystalline on standing, and

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* In the report from H. M.'s Consulate at Newchwang for 1884, it is stated by Dr. Morrison that in that year 13,733 lbs. of the root of this plant were exported from Manchuria for use as an astringent in blenorrhagia and the diseases of women.

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melting below 20°. It consists of free fatty acids. The alcoholic extract contains a sweet tasting, uncrystallizable sugar, not reducing Fehling's solution; the aqueous solution of this extract is not affected by ferric salts, tannin or alkaloidal reagents. After exhausting with alcohol, the residue, on being treated with water, swells up to a white mass like tragacanth, and mucilage and saccharine matter enter into solution. The mucilage is gelatinized by natural plumbic acetate.

Red Behen contains a small amount of white fat soluble in ether and benzol. Alcohol dissolves out a tannic acid, related to cinchotannic acid, and an alkaloid. The alkaloid is bitter, soluble in ether with an opal-blue fluorescence, and forms feathery crystals when evaporated from this solvent. It dissolves in sulphuric acid with a violet-blue fluorescence, which is destroyed by dilution with water and restored by alkalies. We propose the name *Bahmanine* for this new alkaloid. The aqueous extract is mawkish and sweet, containing 6·2 per cent. of glucose. With two volumes of alcohol no mucilage is precipitated, but with four volumes a pulverulent deposit similar to inulin or inuloid is produced. This was collected on a filter, dissolved in boiling water and inverted. The resulting sugar reduced Fehling's solution, and was right-handed towards polarized light.

VOLUTARELLA DIVARICATA, *Benth.*

Fig.—*Wight Ic. t.* 1139; *Bot. Mag. I.* 81, *t.* 4.

Hab.—Central, Western and Southern India. The herb.

Vernacular.—Bádáward (*Pers., Ind. Bazars*).

History, Uses, &c.—This drug is described by Mahometan physicians as the Shaukat-el-baida of the Arabs, the Lúfiniki of the Turks, and the Sanakhúrd of the Syrians. Other Persian names given for it are Kangar-i-sufed and Asfar-i-barí. It is generally described as a thorny plant, about two cubits high, with downy triangular stems as thick as the thumb or larger; heads of seed like those of a thistle, thorny and full of down; flowers purple, seeds like those of carthamus, but rounder. M. M. Husain says:—"Some have supposed this plant to be the same as the Shukai; this is not the case, but the two plants are nearly related. The true Bádáward has slender, white round stems, little more than a span high, slightly downy; flower heads white, surrounding them are three delicate soft spines like needles, so that all together they have much the appearance of a brooch, within is a quantity of white down, which, when the seeds are ripe, causes them to be carried about by the wind, hence the name *Bád-áward*. Medicinally the plant has tonic, aperient and deobstruent properties. It is said to drive away noxious reptiles when kept in the house." (*Makhzan, article Bádáward.*)

The Bádáward sold in India agrees with the description of Mir Muhammad Husain. *V. divaricata* is found on sandy ground in Guzerat, and is thus described in the *Bombay Flora*: "Stem flexuose, short, ramous; branches diffuse, procumbent, angularly striated, sub-glabrous, leaves shortly pubescent or sub-glabrous, those of the stem lyrate, of the branches sinuately pinnatifid, the lobes spinously mucronate, involucre ovate, scales ovate at the base, araneose, terminating in a prickle-like appendage, flowers purple, appear in the cold weather, common in light soils in Guzerat." The drug has a bitter taste; it is imported from Persia.

Chemical composition.—The powdered drug contains a green essential oil having the odour of southernwood. An acid resin and some fatty matter was dissolved out by ether. The alcoholic extract contained an organic acid coloured green with ferric chloride, but unaffected by gelatine. The aqueous solution of this extract was crystalline when evaporated, and gave indications of an alkaloid. The aqueous extract was highly coloured and contained gum. The evaporated filtrate from the gum after standing a few days showed some white crystalline tufts of a gritty substance of an organic nature which was not examined.

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Tricholepis glaberrima, *DC.*, *Dcne in Jacq. Voy. Bot.* 98, *t.* 106, a plant of Central India, Marwar, the Concan and Deccan, *Vern.*—Bramhadandi, is believed by the natives to be a nervine tonic and aphrodisiac. It is a tall, erect, smooth plant, stem angled, leaves linear-lanceolate, acuminate, stem-clasping, distantly spotted with black specks, florets 7 lines long, heads of flowers small, terminal, purple.

CARTHAMUS TINCTORIUS, *Linn.*

Fig.—*Reich. Ic. Fl. Germ. t.* 746; *Bot. Reg. t.* 170; *Rumph. Amb. V.* 79. Safflower, Parrot seed (*Eng.*), Safran batard, Graine de perroquet (*Fr.*).

Hab.—Cultivated throughout India. (*C. oxycantha*, Bieb., is perhaps the wild form of this plant.) The flowers and seeds.

Vernacular.—Kar, Kusumba (*Hind.*, *Guz.*), Kusum (*Beng.*), Kushumba (*Tam.*, *Tel.*), Kusumbe (*Can.*), Kardi (*Mar.*).

History, Uses, &c.—This plant is the Kusumbha of Sanskrit writers, who describe the seeds as purgative, and mention a medicated oil which is prepared from the plant for external application in rheumatism and paralysis. It is the κνίκος of the Greeks,* who used the leaves like rennet to curdle milk in making cheese. Pliny (21, 53,) calls it Cnecos. Mahometan writers enumerate a great many diseases in which the seeds may be used as a laxative; they consider them to have the power of removing phlegmatic and adust humours from the system.

The author of the *Makhzan* states that Kurtum, Hab-el-asfar, and Bazr-el-ahris are the Arabic names for the seeds, and Khasakdanah and Tukm-i-kafshah the Persian. He also says that in Ghilan they are called *Tukm-i-kajrah* or *Tukm-i-kazirah*, in Syria *Káshni*, and in Turkey *Kantawúras*, and that the Greeks call them Atraktus (ἀτρακτυλ(ίς)), and Dioscorides Knikus (κνίκος). Ainslie has the following notice of the plant:—"A fixed oil is prepared from it which the Vytians use as an

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* Theophr. H. P. vi., 1; Arist. H. A. v., 19; Dios. iv., 182.

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external application in rheumatic pains and paralytic affections also for bad ulcers; the small seeds are reckoned amongst their laxative medicines, for which purpose I see they are also used in Jamaica (the kernels beat into an emulsion with honeyed water). Barham tells us that a drachm of the dried flowers taken cures the jaundice." (*Mat. Ind. ii.*, 364.)

The seeds are known in England as Parrot seed. Under the name of safflower the flowers form an important export article to Europe; they contain two colouring matters, yellow and red, the latter is the most valuable. In silk dyeing it affords various shades of pink, rose, crimson and scarlet. Rouge is also made from it. According to Calvert (*Dyeing and Calico Printing, Ed.* 1878,) though the safflower has lost much of its value as a dye since the discovery of the aniline colours, it is still used extensively in Lancashire for the production of peculiar shades of pink of the Eastern markets. It is also used for dyeing red tape, and there is no more striking instance of "red-tapeism," than the love which is shown for this particular colour by the users of that article. Much cheaper pinks can be produced from aniline, but notwithstanding the attempts which have many times been made to introduce them, they have failed in every instance, because the exact shade has not been obtained.

Description.—The Carthamus grows about two or three feet high, with a stiff upright whitish stem, branching near the top; and has oval, spiny, sharp-pointed leaves, their bases half clasping the stem; the flowers grow in heads at the end of the branches, and are surrounded by numerous leafy bracts (involucre) in numerous rows, the outermost row being broad and spreading out flat, with their edges spiny, the middle ones more upright, of an oval form, and surmounted by an egg-shaped appendage with spiny edges, and the innermost much narrower, quite upright, with their edges entire, but terminated by a sharp spiny point. Each flower is perfect, and has an orange or yellow corolla longer than the involucre, their lower part, being imbedded in a dense mass of fringed scales and hairs

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but the chief characteristic consists in the absence of the bristles, technically termed pappus. The fruits are about the size of barley corns, somewhat 4-sided, white and shining like little shells. (*A. Smith, in Treasury of Botany.*)

Chemical composition.—The flowers of *Carthamus tinctorius* contain two coloured principles, one yellow, soluble in water, and of no use in dyeing; the other red, soluble in alkalis, and precipitable by acids from its alkaline solutions; this is *Carthamin.* To prepare it, safflower is first washed repeatedly with water, to free it from the yellow substance, then treated with solution of carbonate of sodium; the liquid is saturated with acetic acid, and pieces of cotton are immersed in it, on which the carthamin is deposited. After twenty-four hours the cotton is removed and treated with solution of carbonate of sodium, which redissolves the colouring matter; the solution is mixed with citric acid, whereby the carthamin is precipitated in red flocks, and, lastly, these flocks are dissolved in alcohol. The solution evaporated in vacuo yields the carthamin in the form of a powder, having a deep red colour with greenish iridescence.

It is sparingly soluble in water, insoluble in ether, but easily soluble in alcohol, yielding a fine purple solution.

According to Schlieper, carthamin has the formula $C^{14}H^{16}O^{7}$. M. Salvétat gives the following figures as representing the composition of safflower :—

Yellow colouring matter soluble in water...	26·1 to 36·0
Carthamin	0·3 to 0·6
Extractive matters............................	3·6 to 5·6
Albumen	1·5 to 8·0
Wax	0·6 to 1·5
Cellulose.....................................	38·4 to 56·0
Silica	1·0 to 8·4
Alumina and oxide of iron	0·4 to 1·6
Manganese	0·1 to 0·5

A certain amount of pectic acid is also always stated to be present.

The yellow colouring matter of Carthamus is acid. It has a bitter taste and great colouring power. It combines readily with oxygen, and is converted into a brown substance. It unites with oxide of lead, forming the compound $(Pb^2O)^3C^8 H^{10}O^5$.

Commerce.—Kusumba is cultivated in most parts of India; it was formerly exported to the value of 6 to 7 lakhs of rupees yearly, but the present value of the exports is under one lakh.

The seed is of considerable importance as an oil seed in India. Value, Rs. 16 per candy of 8 pharrahs (about 5 cwts).

CICHORIUM INTYBUS, *Linn.*

Fig.—*Eng. Bot.* 539. Wild Succory, Chicory (*Eng.*), Barbe de Capucin, Chicorée (*Fr.*).

Hab.— Persia, Europe. Cultivated in India. The seeds.

Vernacular.—Kàsni (*Pers., Ind. Bazars*).

History, Uses, &c.—This plant has been in use as a potherb from a very early period; it was known to the ancient Egyptians, Greeks and Romans. Theophrastus (H. P. vii., 7, 8, 9,10, 11,) calls it κιχωρη and κιχωριον. Dioscorides mentions two kinds,—the wild, κιχωριον, and the cultivated, σερις; he describes both as astringent, cooling and stomachic, and states that the plant is also applied externally on account of its cooling properties in inflammatory affections. The Romans called the plant *Intubus* or *Intubum*, and the plural of the latter word has furnished the Arabs with their name *Hinduba*. Pliny calls the wild plant *Cichorium, Chreston* (useful), *Pancration* (all powerful), and *Ambubaia*; after enumerating its medicinal virtues, he says: "In addition to these qualities the Magi state that persons who rub themselves with the juice of the entire plant, with mixed oil, are sure to find more favour with others, and to obtain with greater facility anything they may desire." Endive seeds were sold in Rome under the names of *Erraticum* and *Ambubaia* or *Ambubeia*, and were supposed to be a panacea and to have the property of fixing the affections. The Syrian dancing girls, whom Cneius Manlius first brought to Rome (*Livy* 9,1), were also called Ambubaia (endive seed), on account of their attractive allurements, just as such persons are often addressed in India as Eláchi-dána (cardamom seeds) for the same reason. Ambubaia is a Syrian term, but the component parts of it Ambui (انبوی) odour, and Baia (بیا) full, occur in old Persian. It signifies full of odours, *i.e.*, allurements. The wild endive is the Tarkashkun of the Persians and of Ibn Sina. Aitchison found it common every where in Khorasan, and also cultivated in gardens as a pot-herb under the name of Kásni. We have sown the seed sold in the Indian bazars, and have obtained a semi-cultivated form of the plant with upright leaves. The same form is cultivated by Mahometans at Hyderabad in the Deccan. The Germans call the wild Endive Wegewarte, "road guardian;" Wegeleuchte "road light;" Sonnenwende or Sonnenwirbel, "solstice;" Sonnenkraut, "sun herb;" and Verfluchte jungfer, "unhappy young girl." According to the legend (*Klytia, Berlin*, 1875,) the plant is supposed to have been once a beautiful princess who, having been deserted by (or lost) her husband (or lover), was at her own request changed into this plant. A full account of the forms which this myth takes in Austrian Silicia, Bavaria and the Tyrol, quoted from Mannhardt, will be found in De Gubernatis (*Myth. des Plant.*, ii, 87), where he compares these legends with those concerning the Basil and Indian Tulasi. Endive is much valued by the Indian hakims as a resolvent and cooling medicine, and is prescribed in bilious complaints much as Taraxacum is in Europe. The seeds are one of the four lesser cold seeds, and, as such, are still much used in the East.

Chicory root dried, roasted and reduced to powder, is very extensively used in Europe as a substitute for coffee and for adulterating that article. Stillé and Maisch state that from 3,500,000 to 4,000,000 lbs. are annually imported into the United States from Europe. The European consumption is probably not less than 20,000,000 lbs.

Description.—The achenes are about the same size as those of the lettuce, angled, of a pale, mottled grey colour.

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The root is fleshy and tapering, somewhat branched, longitudinally wrinkled, light brown externally and whitish internally. The bark is rather thin, radially striate from the dark coloured milk-vessels, and separated by a brown cambium-line from the finely porous yellow wood. The taste is bitter and mucilaginous.

Chemical composition.—Nietzki (*Archiv. d. Pharm.* (3) 8, 327) has separated from the flowers a crystalline colourless glucoside, $C^{32}H^{24}O^{19}$ 4½ aq. insoluble in ether, freely soluble in hot water and alcohol, and dissolving with a yellow colour in alkalies. Boiling dilute acids split it up into glucose and $C^{20}H^{14}O^{9}$, which also occurs in the flowers. This forms needles very slightly soluble in boiling water, and coloured dark green by ferric chloride. According to Dragendorff the cultivated root contains 36 per cent. of inulin. The seeds contain a bland oil. According to König the following figures represent the composition of fresh and dried and burnt chicory :—

	Fresh.	Dry.
Water	75·69	12·16
Nitrogenous matter	1·01	6·09
Fat	·49	2·05
Sugar	3·44	15·87
Nitrogen free extractive.	17·62	46·71
Cellulose	·97	11·00
Ash	·78	6·12

LACTUCA SCARIOLA, *Linn.* var. *sativa.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 1421. Garden Lettuce (*Eng.*), Laitue cultivée (*Fr.*).

Hab.—Cultivated throughout Persia and India. The seeds.

Vernacular.—Káhu (*Pers., Ind. Bazars.*)

History, Uses, &c.—Lettuces have always been greatly esteemed on account of their cooling and refreshing properties.

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In the wild state they produce to a certain extent narcotic and sedative effects, but these appear to be almost entirely removed by cultivation; still, even in the cultivated varieties, a milky and bitter juice exists in the flower stem. Lettuces θρίδαξ* appear to have been used for salads at a very early period. According to Herodotus, they were served at the tables of the Persian kings more than 400 years before the Christian era. The opium of Galen is supposed to have been Lettuce opium. The Greeks and Romans considered the lettuce unlucky, and used it only at funerals as a food.

Apuleius (*De Vir. Herb.*) speaks of it as a valuable medicinal herb—

"Herbæ lactucæ sylvaticæ succum cum vino optimo vetere et melle acapno quod sine fume collectum est, mixtum in ampullam vitream condito, et eo utaris, summam medicinam experieris." The seeds are one of the four lesser cold seeds of old writers, and as such still retain their position in the Materia Medica of the East. Mir Muhammad Hussain in his *Makhzan* mentions several kinds of lettuce, and also lettuce opium; but he acknowledges the superiority of the lettuces raised from English seed in India over those of Persia, and enlarges upon the cooling and purifying action of the herb upon the blood. The lettuce seed of the bazars is white: it is imported from Persia, and is sold for Re. ½ per lb.

The Arabic name is *Bazr-el-khas* and the Persian *Tukm-i-káhú.* Both plant and seed are too well known to require description.

Chemical composition.— Lactucarium is a brown viscid substance obtained by evaporating the juice, which exudes when the stems of the wild lettuce are wounded. It has a peculiar opium odour and acts as a narcotic. German lactucarium contains, according to Ludwig, from 44·4 to 53·5 per cent. of *lactucone*; a soft resin; about 4 per cent. of an easily fusible waxy body; *lactucin*, the chief active principle of the substance;

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*Also θριδακίνη, Theoph. H. P. I., 16, 19, vii, 1 to 5. The wild lettuce, θρ. αγρια, vii., 6.

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lactucic acid; about 1 per cent of oxalic acid; a non-volatile not bitter acid which reduces oxide of silver; and a volatile acid smelling like valerianic acid, both in small quantity only; about 7 per cent. of albumin; at least 2 per cent. of mannite; a small quantity of a neutral, not bitter, unfermentable substance, crystallising in rhomboid pyramids; and from 3 to 6 per cent. of ash, containing potash, soda, manganic oxide, ferric oxide, and a small quantity of lime. Lactucin is yellowish, fusible, bitter, soluble in 80 parts of cold water, moderately soluble in alcohol and in acetic acid, less soluble in ether which deposits it on evaporation in nacreous scales or rhombic tables. Formula according to Walz, $C^{40}H^{48}O^{15}$. The leaves of the cultivated lettuce were found by Church to contain water 95·98 per cent.; albuminous matter 0·71; starch, sugar and gum 1·68; cellulose and lignose 0·52; chlorophyll and fat 0·22; ash 0·89. The ash was very rich in nitrates.

König gives the following as the mean composition of the garden lettuce:—

Water	94·33
Nitrogenous matter	1·41
Fat	·31
Non-nitrogenous extractive	2·19
Cellulose	·73
Ash	1·03

TARAXACUM OFFICINALE, *Wigg.*

Fig.—*Reich. Ic. Fl. Germ. xix. tt.* 1404—1406; *Woodville, t.* 16; *Bentl. and Trim. t.* 159. Dandelion (*Eng.*), Pissenlit (*Fr.*)

Hab.—Throughout the Himalaya and the Nilgiris. Cultivated in N.-W. Provinces. The root.

Vernacular.—Dudhal, Baran, Kánphúl (*Hind.*).

History, Uses, &c.—The derivation of the mediæval name Taraxacum is uncertain, but it seems not improbable that it was a corruption of the Persian طرخشقون (Tarkhashkún), the name of a kind of wild endive mentioned by Ibn

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Sina, which he describes as useful in dropsy and obstructions of the liver. The same plant is noticed by other Arabian and Persian writers, all of whom describe it as the wild endive, and some of whom add that it has bluish flowers.

The Greeks and Romans speak of several varieties of endive, but there is nothing in their descriptions to lead us to suppose that they were acquainted with our Taraxacum. Fuchsius (1542) figured *T. officinale* (*Ic.* 391. *f.*), and named it *Hedypnois*, a name given by Pliny (20, 31) to one of his kinds of wild endive. Tragus (1552) figured it under the name of *Hieracium majus*. Matthiolus (1583) called it *Dens leonis*, and Linnæus (1762) *Leontodon Taraxacum*, on the supposition, apparently, that it was the Tarkhashkún of Ibn Sina. At the close of the last century dandelion began to be much used as a remedy for chronic obstructions of the liver and bowels, and as a diuretic in calculous affections. From experiments made by Rutherford and Vignal, it appears that taraxacum is but a feeble hepatic stimulant, but it has powerful diuretic properties. Taraxacum is very popular in India in cases of hepatic congestion due to, or associated with, atonic dyspepsia and constipation; indeed, it has become quite a domestic remedy in this country. It is cultivated as an annual crop at Saharanpur for the use of the Government sanitary establishments. The Madras Medical Stores are supplied with the root from the Nilgiris.

Description.— The perennial root is from 6 to 12 or 16 inches long, nearly cylindrical, ½ to 1 inch thick, crowned with several short thickish heads above and furnished with few branches below. Fresh, it is light yellowish-brown and fleshy; when dry, dark brown or blackish-brown, much wrinkled longitudinally; internally, it is white with a yellowish centre. It is inodorous and has a bitter taste. It is hygroscopic, and in damp weather rather flexible, but when dry breaks with a short fracture, showing the pale yellow porous wood surrounded by a dark brown cambium-line and a thick white bark, with concentric circles of milk-vessels of a brownish colour, and separated by layers of thin-walled and axially elongated parenchyma. The meditullium has no medullary rays, and consists mainly of ducts varying in diameter and more or less interspersed with thin-walled, elongated cells.

After frost and early in the spring the root is sweet; during the spring and summer the milk-juice becomes thicker and the bitter taste increases; the root is, therefore, directed to be collected late in the autumn. The spring root yields a bitterish-sweet extract. Bentley regards the root collected about July as most efficient. (*Stillé and Maisch.*) The annual root as cultivated in India is very much smaller.

Chemical composition.—The bitter principle, *Taraxacin*, was obtained by Polex (1839) in a crystalline state by treating the milk-juice with boiling water and evaporating. Kromayer (1864) found it necessary to leave the aqueous solution in contact with animal charcoal, from which afterwards alcohol dissolved the bitter principle, requiring treatment with lead acetate and sulphuretted hydrogen to free it from colouring matter and other principles. Kromayer obtained taraxacin as an amorphous bitter mass. The milk-juice contains also *resin* and *taraxacerin*, $C^{8}H^{16}O$, which is insoluble in water, crystallizes from hot alcohol, and when in an alcoholic solution has an acrid taste. The dry root yields from 5 to 7 per cent. of ash.

Dandelion root collected in autumn is rich in inulin. Dragendorff (1870) obtained from the root collected in October 24 per cent. of inulin and a little sugar, but when collected in March only 1·74 per cent. of inulin was found, and about 18 per cent. each of uncrystallizable sugar and *levulin*, the latter being intermediate between inulin and sugar in having the composition of inulin, but being of a sweet taste, soluble in cold water, and without influence on polarized light. Frickhinger (1840), Widemann, and others had obtained notable quantities of *mannit* from the concentrated juice of dandelion, but T. and H. Smith (1849) proved that this principle does not pre-exist, and that, on the contrary, it is a product resulting from fermentation.

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The presence of fermentable sugar has been observed by most investigators, and Dragendorff's observations confirm the results previously obtained by Frickhinger, Widemann, and Overbrook, that the sugar predominates in the spring root, and inulin in the root collected in autumn. It seems to follow therefrom that the extract and other preparations made from the expressed juice or by treating the autumn root with cold water should be more efficacious and less loaded with inert matters (sugar, &c.) than those obtained from the spring root. Old extract of taraxacum sometimes contains granular crystals of calcium lactate (Ludwig, 1861); the lactic acid is probably produced from *inosit*, which, according to Marmé (1864), exists in the leaves and stalks of dandelion, but is not found in the root. (*Stillé and Maisch.*) The fresh plant, which is used in Europe as a salad, has been analysed by H. Storer and S. Lewis, who found it to consist of Water 85·54, Nitrogenous substances 2·81, Fat 0·69, Non-nitrogenous extractive 7·45, Cellulose 1·52, Ash 1·90. In the dried plant they found Nitrogen 3·11, Carbohydrates 51·52 per cent. (*König, Nahrungs Mittel.*)

Substitutes for Taraxacum.

Launæa pinnatifida, *Cass.*, *Wight Ill.*, *t.* 133, a native of the sandy coasts of India, is much used at Goa as a substitute for Taraxacum under the name of *Almirao*. The plant has a filiform, procumbent stem bearing roots and leaves here and there; leaves crowded, sinuate-pinnatifid, lobes obtuse or subacute; peduncles rather shorter than the leaf, having at the top scaly bracts which are scarious on the margin. The roots are fleshy, about the size of a crowquill, and 6 to 8 inches long; when fresh they are yellowish-white. A section shows a yellow central fibro-vascular column, containing very large fenestrated vessels arranged in a radiating manner Beyond the radii the parenchyma is loaded with large colourless bodies of irregular size and shape, which gradually diminish in number towards the cortex, where the parenchyma is not occupied by them The cellular structure is delicate and the cells large. These bodies appear to be cells distended by some solid nearly transparent matter (inulin ?) as they correspond in form and position with neighbouring empty cells. In Bombay under the name of *Pathri* it is given to buffaloes to promote the secretion of milk. Murray refers the Ban-káhú of Sind to this plant, but his description agrees better with that of *Launæa nudicaulis*, Less. He says the juice of the Ban-káhú, called *Khee-khowa,* is used as a soporific for children in doses of half a massa, and is externally applied in rheumatic affections combined with the oil of *Pongamia glabra* or the juice of the leaves of *Vitex leucoxylon.*

Lactuca Heyneana, *DC., Wight Ic., t.* 1146, is also used as a substitute for Taraxacum, and is called by the Portuguese *Taraxaco.*

Emilia sonchifolia, *DC., Rheede Hort. Mal. x. t.* 68, appears to be used all over India much in the same manner as Taraxacum. Rumphius figures it, and says that the Portuguese call it Erva do Figado, *i.e.*, hepatis herba. It is the Muelschevi of Rheede, who says—" Decoctum antifebrile est et asthmaticum, succus ventris sedat fluctus cum saccharo assumptus. Contrita cum butyro apostemata maturat et aperit."

E. sonchifolia is the *Sadamandi* of Western India, the *Shudimudi* of Bengal, the *Kadoo-para* of Ceylon, where it is used as a sudorific, and we have received it from Cawnpore under the name of *Hiran-khuri.* It is a very common weed of cultivation, and may be found in every Indian garden.

Sonchus oleraceus, *Linn., Wight Ic. t.* 1141, the Milk Thistle of the English and Laiteron of the French, is used in decoction as a laxative and emollient drink in chronic affections of the digestive organs. Dr. F. Landry (*Med. Bullet.*—1888) has pointed out that the inspissated juice, given internally in doses of 12 to 25 centigrams, is an active hydrogogue cathartic acting on the liver, duodenum and colon. Like elaterium, it produces copious watery stools, and would appear likely to be useful in ascites and hydrothorax. Its administration

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requires watching, as like senna it causes griping and like aloes tenesmus. Dr. Landry suggests its combination with manna, anise and carbonate of magnesia; or with stimulants and aromatics. (*Pharm. Journ.*, *Sept* 1888.) This weed is common in many parts of India in fields and cultivated places.

Some plants of minor importance used medicinally and belonging to this Order are:—

Echinops echinatus, *DC.*, the Utáti of Sanskrit writers and the Utkatára of the bazars. It is a thistle-like plant 1 to 2 feet high, with pinnatifid spinous leaves, the under surface of which is cottony. The flower heads are about 1 inch in diameter and armed with many stout spines. The root is tapering and of a whitish brown colour. The drug is considered to be tonic and diuretic. It is bitter and appears to us to have much the same properties as the *Carduus benedictus* of Europe.

Dicoma tomentosa, *Cass.*, *Wight Ic.*, *t.* 1140. *Vern.*—Navananji-cha-pála (*Belgaum*). An erect much-branched annual, 10 to 18 inches high, clothed with white cottony wool; leaves sessile linear or linear-obovate, obtuse or acute, quite entire, cottony, 1 to 3 inches long; heads sub-axillary, involucre bracts, ½ to ⅔ in., subulate, spinescent, straight, glabrous, shining; achenes broad and short, ⅛ in. long, turbinate, densely silky; pappus shining, elastic, brush-like. The herb is strongly bitter, and is used in the neighbourhood of Belgaum as a febrifuge, especially in the febrile attacks to which women are subject after childbirth. Dr. Peters, of the Bombay Medical Service, first brought to notice the use of this plant medicinally by the natives.

Notonia grandiflora, *DC.*, *Deless. Ic. Sel. iv.*, *t.* 61; *Wight Ic. t.* 484. *Syn.*—Cacalia Kleinia, Herb. Madras. The *Wánder-roti* of the Mahrattas, was named by DeCandolle after Mr. Benjamin Noton of Bombay, who first met with it on the Nilgiris; it is also found upon high rocky precipices in the Deccan. In 1860, Dr. A. Gibson brought forward this plant as a preventive of hydrophobia. The mode of adminstration is as follows: about four ounces of the freshly gathered stems, infused in a pint of cold water for a night, yield in the morning, when pressed, a quantity of viscid greenish juice, which being mixed with the water, is taken at a draught. In the evening a farther quantity of the juice, made up into boluses with flour, is taken. These medicines are directed to be repeated for three successive days. The Editor of the *Pharmacopœia of India* says that from official documents placed at his disposal, it appears that the remedy has been tried in numerous cases; but as at the time of the infliction of the wound, caustic was applied locally in the majority of cases, it is difficult to determine how far the Notonia operated, if at all, as a prophylactic. (*Phar. of India, p.* 126.)

An extract of the herb was tried by the late Dr. Haines and one of us on dogs, and afterwards at the European Hospital in Bombay (1864). In one drachm doses it had a feebly aperient action; no other effect was observed. The dried plant was for a time issued to medical officers in Government employ, but no further information as to its properties would appear to have been obtained. *N. grandiflora* is a shrub, fleshy, smooth; stem thick, round, marked with the scars of fallen leaves; leaves oblong or ovate, entire; flowers terminal, corymbose, few, pale yellow. The dry stems, which are white, soft and fragile, yield an abundant greenish extract.

Tagetes erecta, *Linn. Bot. Mag. t.* 150. French Marigold (*Eng.*), Œillet d'Inde, Rose d' Inde (*Fr.*), Makhmal, Gul-jáferi (*Hind.*), Rojia cha phúl (*Mar.*), is quite naturalized in India. One tola of the juice of the petals heated with an equal quantity of melted butter is given daily for three days as a remedy for bleeding piles; they are considered to have a purifying action upon the blood. The flowers of this plant are much used for making garlands to hang over doorways on festive occasions. Rojia (rose), the name current on the Western Coast, was probably introduced with the plant by the Portuguese, with whom it appears to represent the *Rosa de ouro* or golden rose, which the Pope usually blesses at mass on a Sunday in Lent.

Anaphalis neelgerriana, *DC., Prodr.* vi. 272, and other species are used on the Nilgiris for cut wounds. The leaves are covered with woolly down, and are called by the natives *Kaat-plaster* or country plaster. The fresh leaves are bruised and applied to the wound under a rag.

The flowers of **Carduus nutans**, *Linn. Reich. Ic. Fl. Germ. t.* 146, *Vern.*—Kanchari, are employed as a febrifuge in Sind and in the Punjab.

Calendula officinalis, *Linn.* The pot Marigold (*Eng.*), Souci des jardins (*Fr.*), *Bot. Mag. t.* 3204, a native of the Mediterranean Coasts, formerly esteemed as a domestic remedy, is found as a weed of cultivation in Northern India.

CAMPANULACEÆ

LOBELIA NICOTIANÆFOLIA, *Heyne.*

Fig.—*Wight Ill.*, t. 135. Wild Tobacco (*Eng*).

Hab.—Bombay to Travancore, Ceylon. The plant.

Vernacular.—Dhavala (*Mar.*), Kattu popillay (*Tam.*), Adavipogaku (*Tel.*), Kadahogesappu (*Can.*).

History, Uses, &c.—This Lobelia was first described by Heyne, who found it near Bangalore. We have met with no mention of the plant in native medical works, but the Marathi name appears to be of Sanskrit origin and to signify "white," probably in allusion to the colour of the flowers. Graham (*Bombay Plants*) states that the dried stalks, which are hollow in the centre, are sold in the bazar at Mahableshwar, and used as Koluri horns for collecting herds of cattle and scaring wolves. In the Concan a kind of rustic pipe called पांवा (páṇvá) is made from them. In the *Pharmacopœia of India* an infusion of the leaves is said to be used as an antispasmodic. The dry herb when handled is extremely acrid, the dust irritating the throat and nostrils. It is called wild tobacco among the Tamils and is regarded by the natives as poisonous wherever the plant grows. Physiological experiments conducted by Herr von Rosen at Dorpat have shown that this plant has properties exactly similar to those of *Lobelia inflata.* The physiological action of poisonous doses of lobelia upon the carnivora and upon man is to cause death by paralysing the respiratory centre. Small doses first raise and then depress the blood pressure; large doses paralyse the vasomotor centre and the peripheral ends of the vagi. (*Attwood.*) The effects produced by lobelia on man have been carefully studied by Barallier of Toulon, who found that after taking an infusion of 1 grain of the leaves in 400 grains of water, he felt a burning and rawness in the fauces, headache, and a sensation of constriction beneath the sternum; his pulse became weak, slow and intermittent, and there was diuresis. Larger doses produced general muscular weakness, vomiting, difficult breathing, cardiac depression, reduction of temperature and dilatation of the pupils. The action of lobelia is therefore similar to that of tobacco and its alkaloid nicotine. (*Barallier, Des effets physiol., &c., de la Lobelia inflata. Bull. de Therap.,* lxvi.)

The chief medicinal value of lobelia is in the treatment of asthma, whether the disease be purely spasmodic or associated with pulmonary emphysema, chronic bronchitis, heart disease, &c. It eliminates from the attack the bronchial spasm, which in the first-named affection constitutes the whole disease, and in the others is a complication only. A fluid drachm of the tincture should be given every hour, or, if the symptoms are urgent, every half hour, until relief is obtained, or the characteristic effects of the medicine are produced. Its efficacy in other diseases, as in whooping cough, will depend mainly upon the predominance of the nervous element in them. Whenever dyspnœa is due to inflammatory changes in the bronchia, or to the presence in these tubes of secreted matters, rather than to spasm, lobelia displays special virtues that entitle it to be preferred before numerous "expectorants." It is of no more advantage in inflammatory laryngitis than various other nauseants and emetics, but it is decidedly more effica-

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cious in spasmodic laryngitis than most other remedies of the same class. In almost all cases in which distress in breathing arises from a want of proper balance between the lungs and the heart, this medicine affords relief; as, for instance, when the lungs are congested by mitral obstruction and there is a tendency to œdema of those organs; and, again, when the lungs are themselves diseased so as to interfere with the cardiac circulation, as occasionally happens even in tuberculous consumption. (*Stillé and Maisch.*)

Description.—The leaves resemble those of the tobacco; they are finely serrated and covered with simple hairs. The lower part of the stem is woody, an inch and a half or more in diameter, and almost solid; the upper portion is a hollow tube ending in a crowded head of flower spikes; the latter are about a foot in length, and when the plant is in fruit, are thickly set with globular capsules about the size of a pea, to which a portion of the dry flower is often adherent; the capsules are two-celled, each cell containing a fleshy placenta. The seeds are numerous and very small (1-50th of an inch in length), oval, flattened, of a light brown colour, and marked with delicate lines. Several small tubercles surround the site of the placental attachment.

The whole plant when dry is studded with small spots of resinous exudation, and is hot and acrid to the taste. The leaves and aerial parts of the fresh plant exude a white latex when broken.

Chemical composition.—Herr von Rosen's examination of the plant, supplied by one of us, showed it to contain two alkaloids; this led to a re-examination of *Lobelia inflata*, with the result that two similar alkaloids were found to be present in the latter plant. The discovery of von Rosen has been confirmed by J. U. and C. G. Lloyd (*Pharm. Rundschau*, 1887), but they describe the alkaloids somewhat differently; one, for which they appropriate the name *Lobeline*, was obtained as a colourless and odourless amorphous substance, non-hygroscopic, and apparently not affected by air; slightly soluble in water, and

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readily soluble in alcohol, chloroform, ether, benzol and carbon bisulphide. Its salts are most powerful emetics, producing emesis without disagreeable after symptoms.

The other alkaloid *Inflatine* was obtained in large colourless, odourless and tasteless crystals, insoluble in water or glycerine, but soluble in carbon bisulphide, benzol, chloroform, ether and alcohol.

Therapeutically inflatine has no apparent importance. In spite of the statements of previous workers, no volatile or liquid base was met with by the authors, and it would seem probable that the supposed liquid alkaloid previously observed was a mixture of lobeline, inflatine and oil.

ERICACEÆ.

GAULTHERIA FRAGRANTISSIMA, *Wall.*

Fig.—*Wall. in As. Research.* xiii., 397; *Wight. Ic. tt.* 1195—96; *Bot. Mag.* 1984. Indian Wintergreen (*Eng.*).

Hab.—Hills of India, Burma and Ceylon. The essential oil.

Vernacular.—Gandapuro (*Jav.*).

History, Uses, &c.—This ramous shrub with thick coriaceous leaves, white flowers and blue berries, inhabits the grassy hills and affords an essential oil nearly identical with that of *Gaultheria procumbens* (*Canadian Winter Green*). Mr. Broughton, the late Government Quinologist at the Nilgiris, in a report to the Madras Government on the subject of this oil, says:—"The oil from this source contains less of the peculiar hydrocarbon which forms a natural and considerable admixture with the Canadian oil, and therefore is somewhat superior in quality to the latter. The commercial demand for the oil is not, however, considerable enough to make its occurrence in India of much direct importance.

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"It occurred to me in 1869 that methyl-salicylic acid would, however, under suitable treatment, furnish carbolic acid according to a decomposition described by Gerhardt. After a few experiments I was successful in preparing considerable quantities of pure carbolic acid. The method of manufacture is as follows: —The oil is heated with a dilute solution of caustic alkali, by which means it is saponified and dissolved, methylic alcohol of great purity being liberated. The solution of the oil is then decomposed by any mineral acid, when beautiful crystals of salicylic acid are formed. These are gathered, squeezed, and dried. They are then mixed with common quicklime or sand, and distilled in an iron retort; carbolic acid of great purity, and crystallizing with the greatest readiness, passes into the receiver. This acid is equal to the purest kind obtained from coal tar, and employed in medicine. It, of course, possesses all the qualities which have rendered this substance almost indispensable in modern medical and surgical practice. (*Pharm. Journ.*, *Oct.* 1871.)

The shrub has no vernacular name on the Nilgiris, and does not appear to be used by the natives except the berries which are eaten by the Badagas. The *Gandapuro* of Java (Ainslie, *Mat. Ind.* ii. 106) is referred to an Andromeda, and it is interesting to notice that on the authority of Dr. Horsfield, the volatile oil was used by the natives in rheumatic affections. Dr. de Vrij obtained a considerable quantity of oil from the leaves of two Javanese species, *G. leucocarpa* and *G. punctata*, and this was found by Köhler to be identical with Canadian Wintergreen oil.

Wintergreen oil is used as a flavouring agent on account of its agreeable odour. It is a convenient antiseptic, a drop or two of the oil will preserve a bottle-full of gum or of ink from mould for several months, and it is a useful adjunct to hypodermic injections and other pharmaceutical preparations. In large doses it produces the same effect as other aromatic essential oils. The large proportion of methyl salicylate contained in the oil naturally led to its employment in rheumatism. It was apparently first used for this purpose by Mr. Casamayor of Brooklyn, N. Y. (*Ephemeris*, i. 30), and next by Dr. Kinnicutt of New York (*Med. Record*, xxii. 505). Twelve cases of acute articular rheumatism treated by the latter gave an average duration of the pyrexia of 3½ days; of the joint pains, 4½ days; of the stay in hospital, 24½ days. The oil was given at first in doses of 10 minims every two hours until eight doses had been taken, and afterwards the doses were increased as well as their frequency. The reporter believes that his cases presented less than the usual proportion of heart-complications; but if so, the oil must differ in its effects from its active element, salicylic acid. Dr. Austin Flint (*Phila. Med. Times*, xiii., 846,) and Dr. Gottheil (*Med. Record*, xxiv., 258,) have reported analogous results. Dr. Waring (*Brit. Med. Journ.*, June 6th, 1885) suggests the Indian oil for use as a stimulant, carminative and antiseptic.

Dr. Charteris, after experimenting on the comparative action of natural and artificial salicylic acid, concludes that the restlessness, confusion, delirium and retarded convalescence attendant on the use of the acid and its sodium salt in acute rheumatism is due to the impurities of the acid prepared from coal-tar, and that natural salicylic acid and its salts are much safer remedies (*Brit. Med. Journ.*, Nov. 1889).

Description.—Oil of gaultheria is usually of a reddish colour, but may be obtained colourless by rectification. According to I. E. Leonard (1884), the colour is usually due to the presence of a little iron, and is readily removed by citric acid. It has a strong and agreeable aromatic odour and a sweetish, warm, aromatic taste, and begins to boil at a little above 200° C. Its specific gravity is 1·180 at 15° C. Occasionally, oil of gaultheria is lighter (1·170), in consequence of containing a light hydrocarbon, but the extent of this variation has not been fully determined. The oil is neutral or faintly acid to test-paper; has a slight dextrogyre rotation, and dissolves readily in alcohol and but to a small degree in water; the solutions acquire a dark-purple colour on the addition of ferric chloride. The pure-oil is not coloured on the addition of strong nitric acid, but soon congeals into colourless crystals of a nitro-compound. A solid crystalline mass is also obtained on agitating the oil with concentrated solution of potassa or soda. (*Stillé and Maisch.*) The Nilgiri oil has a sp. gr. of 1·087 at 15·5, and has no action on polarized light.

Chemical composition.—Procter (1842) recognized the presence in this oil of salicylic acid. Cahours subsequently (1843) proved it to consist to the amount of about 90 per cent. of methylsalicylic acid (methyl salicylate or mono-methylsalicylic ether), $CH^3C^7H^5O^3$. 100 grains of the oil contains 81 grains of salicylic acid. Pure methyl salicylate is a colourless oil, has the specific gravity of 1·18, boils at 222° C. (Cahours), and forms crystalline compounds with the alkalies. The remaining constituent of oil of wintergreen—of which Pettigrew (1884) obtained only 0·3 per cent.—is *gaultherilene*, a colourless thin hydrocarbon of the formula $C^{10}H^{16}$, boiling at 160° C., and having a strong peculiar odour, described as pepper-like by Cahours. Trimble and Schrœter determined the hydrocarbon to be a sesquiterpene of the formula $C^{15}H^{24}$, and obtained crystals similar to benzoic acid from the oil.

Commerce.—The leaves yield more oil in the fine weather, from January to April, than at other times of the year; but owing to the sluggishness with which it comes over in the still, it could not be sold for much less than Rs. 6 per pound. The preparation of carbolic acid from the oil to compete with that from coal tar is out of the question at the present time but it might, with advantage, be used in making salicylic acid reducing the price of the natural acid which is quoted in London at 2*s.* 6*d.* per ounce.

PLUMBAGINEÆ.

PLUMBAGO ZEYLANICA, *Linn.*

Fig.—*Rheede Hort. Mal.* x., *t*, 8; *Wight Ill.*, *t.* 179.

Hab.—Throughout India. The root.

PLUMBAGO ROSEA, *Linn.*

Fig—*Rheede Hort. Mal. x., t.* 9; *Bot. Mag. tt.* 230,5363.

Hab.—Sikkim, Khasia wild? Cultivated in India.

Vernacular.—Chitrak, Chita (*Hind.*), Chitra (*Guz.*), Chitraka (*Mar.*), Chita (*Beng.*), Chitri (*Can.*), Chittira (*Tam.*), Chitra, Agnimata (*Tel.*), Kotu-veli (*Mal.*), *P. rosea* bears the same names with the addition of the adjective *red.*

History, Uses, &c.—These plants, in Sanskrit Chitraka, are described as digestive, light, astringent, hot and appetizing; a remedy for dyspepsia, piles, leprosy, anasarca, worms, cough, phlegm, wind and biliousness. In the Nighantas, among other synonyms, they bear the names Dáruna, Dahana, and Agni, in allusion to their burning and acrid properties. *P. zeylanica* is much used as a stimulant adjunct to other preparations, in the form of a combination called *Trimada*, consisting of Plumbago root, Báberang (fruit of *Embelia Ribes*), and Nágarmoth (tubers of *Cyperus pertenuis*). It enters into the composition of numerous medicines for dyspepsia. The following is an illustration: Take of Plumbago root, Rock salt, Chebulic myrobalans and long pepper, equal parts; powder and mix. Dose about 40 grains. (*Chakradatta.*) A favourite medicine for flatulence is an old prescription of Susruta's called Shaddharanayoga. It is a powder composed of equal parts of the following substances: Plumbago root, seeds of *Holarrhena antidysenterica*, roots of *Cissampelos Pereira*, of *Picrorrhiza Kurroa* and *Aconitum heterophyllum*, Chebulic myrobalans. Dose about 1 drachm. The root of *P. zeylanica* is said to exercise a beneficial effect on piles, in which disease it is given in various combinations. One mode of administering it is as follows:—An earthen jar or pot is lined in its interior with a paste of the root, and curdled milk (dadhi) or Kanjika (rice vinegar) is prepared in this pot. Plumbago root reduced to a paste is applied to abscesses with the object of opening them. It enters also into the composition of several preparations used as caustics. Religious mendicants attending fairs use the root for the purpose of raising sores upon their bodies in order to obtain pity and alms. In the Concan the following formula is used:—Chitrak root, Emblic myrobalans, small black myrobalans (Bál-hartaki), Long pepper, Pepper root, Rhubarb and Rock salt. Powder and give 6 mashas (90 grains) with hot water every night at bed-time in flatulence with rheumatic pains.

In paralysis, the bark, with Cratæva bark, Indian elm bark (Vávalá), Wild Moringa bark, and the bark of *Vitex trifolia*, is boiled in one part of white, and two of black mustard oil and applied. Mahometan writers treat of the drug under the name of Shítaraj, a corruption of the Indian name Chitrak; they describe it as caustic and vesicant, an expellant of phlegmatic humors; useful in rheumatism and spleen, digestive; it also causes abortion. For external administration it is made into a paste with milk, vinegar or salt and water. Such a paste may be applied externally in leprosy and other skin diseases of an obstinate character, and be allowed to remain until a blister has formed. In rheumatism it should be removed after 15 to 20 minutes. When administered internally the dose is one dirhem. Mír Muhammad Husain speaks of several kinds of Shítaraj, and says one of them is the Líbádiyún or Lífádiyún of the Greeks. Rhazes describes two kinds, Indian and Syrian.*

The Shítaraj of Mahometan writers must, therefore, be considered to refer to the genus *Plumbago*, and not to any particular species. *P. zeylanica* is mentioned by several European writers upon Indian drugs, but has not attracted the same amount of attention as *P. rosea*, which is said to be more active. However, this may be, the former is the Chitrak of the native physicians, and very possibly may have been used by some under the supposition that it was the root of *P. rosea.* In the *Pharmacopœia of India,* Dr. Oswald is said to have employed *P. zeylanica* in the treatment of intermittents with good effect. It acts as a powerful sudorific. In many parts of India the root is one of the most important drugs of the itinerant herbalist; it is also sold by all druggists. Ainslie, speaking of *P. rosea,* remarks.—"The bruised root of this plant is, in its natural state, acrid and stimulating, but when tempered with a little bland oil, it is used as an external application in rheumatic and paralytic affections; it is also prescribed internally in small doses for the same complaints, in combination with some other simple powder." (*Mat. Ind., II., p.* 379.)

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* *Plumbago europæa* is considered to be the *τριπολιον* of Dioscorides by Sprengel. *λιβάδιον* or *fel terræ* is the name of a plant mentioned by Pliny (25, 31), which has not, we believe, been identified by European writers with Plumbago.

O'Shaughnessy, who instituted a series of trials with the root as a vesicant, has expressed a very favourable opinion of it as a cheap substitute for cantharides. Dr. Waring thinks less favourably of it; he found that it caused more pain than an ordinary blister, and that the resulting vesication was less uniform, and not always easily healed. From what we have seen of its use, we are inclined to support Dr. Waring's opinion. Given internally in large doses, Plumbago root acts as a narcotico-irritant poison. In small doses it acts first as a powerful stimulant of the mucous membrane of the digestive organs, and after absorption, as a stimulant of the excretory glandular organs. Its action is well worthy of accurate scientific investigation.

Description.—The roots of *P. zeylanica* are from ¼ to 2 or more inches in diameter, seldom branched. When dry, the external surface of the bark is of a dark reddish brown colour, somewhat shrivelled, and marked here and there by small warty projections; internally it is brown and striated; the fracture is short; the taste acrid and biting. Wood hard, reddish, close-grained. A section of the fresh bark when magnified shows numerous bundles of bright yellow stone cells forming an irregular zone towards the inner part of the middle layer of the bark. The cells of the parenchyma are large and contain much starch. In the dried root the yellow plumbagin

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is seen in the cell walls both of the parenchyme and the woody tissue, but not in a crystalline form. (*Flückiger and Gerock.*) The root of *P. rosea* has a similar structure, but is much smaller.

Chemical composition.—The activity of the drug depends upon the presence of *plumbagin.* This acrid principle was first separated by Dulong from the root of *P. europœa* by repeatedly boiling the ethereal extract with water, whence it was deposited on cooling, and purified by crystallization from alcohol or ether-alcohol. Plumbagin crystallizes in delicate needles or prisms, often grouped in tufts; has a styptic saccharine taste, with acrid biting after taste; melts very easily, and partly volatilises unaltered when heated. It is neutral, nearly insoluble in cold, more soluble in boiling water, very soluble in alcohol and ether. It dissolves with yellow colour in strong sulphuric and fuming nitric acid, and is precipitated by water in yellow flocks. Alkalies change the colour of the solution to a fine cherry-red; acids restore the yellow colour. Flückiger (1887) examined the root of *P. zeylanica* supplied by one of us, and found that plumbagin could be obtained by submitting it to steam, when the latter is carried off by the water, from which it can be separated by shaking with ether. On evaporating the ether fine crystalline tufts of plumbagin of a bright orange colour are obtained: they have a peculiar odour and an intensely acrid, but not bitter taste. On heating them but very moderately, they are volatilized; they readily dissolve in alkaline solutions and impart to them a red colour, but at the same time the plumbagin is altered, probably by oxidation. The yield is very small, from about 50 lbs. of root only 31 grains of raw plumbagin could be obtained. Professor Flückiger found the proportion of plumbagin in *P. europœa* to be about the same as in *P. zeylanica.* An acid was also separated from the root by distillation. M. Greshoff, who has been investigating the chemistry of the medicinal plants of Java (*Meded. uit S'lands Plant.* VII., p. 55, Batavia, 1890,) is of opinion that the roots (supposed to be from *Rauwolfia serpentina*) examined by

Wefers Bettink (*Haaxmans Tijdsch.*, Jan., 1888,) were really those of *Plumbago rosea.* Prof. Bettink extracted with chloroform a yellow crystalline principle, apparently the plumbagin of Dulong, which on crystallization from hot water and several times from alcohol was obtained in needles melting at 72° C., and showing the composition $C^{16}H^{13}O^{6}$. It was with difficulty soluble in water, but easily soluble in chloroform, benzol, carbon bisulphide and glacial acetic acid. On careful heating it sublimed, the yield was about 0·2 per cent. The principle somewhat resembled Juglone and possessed anthelmintic properties.

A further examination *P. europæa* made in 1889 by Prof. Flückiger and Mr. T. E. Gerock, showed that plumbagin is not contained in the aërial parts of the plant, with the exception of a small quantity in that part of the stem which is near the root. They found the root, when freshly cut, to be nearly devoid of colour, but on exposure it immediately assumed a yellow hue, from which they conclude that the plumbagin is probably the product of a rapid oxidation of some primary substance contained in the plant. In the dried root the plumbagin is seen in the cell walls both of the parenchyme and of the woody tissue, but not in a crystalline form. We have submitted to steam two cwts. of bazar plumbago root, and on shaking the distillate with ether obtained half a fluid ounce of a deep yellow oily fluid having a peculiar penetrating odour. On cooling it artificially, a few colourless crystals formed, which redissolved when the oil was gently warmed. The oil floated on water, and the mixture was unaffected by dilute acids and alkalies and salts of iron, lead, mercury and silver; it dissolved readily in ether and bi-sulphide of carbon, and to a small extent in rectified spirit. It struck a reddish colour, without dissolving in sulphuric acid. A drop of the oil in a watch glass was solidified by passing the vapour of ammonia over it. Heating on a water bath for two days was not sufficient to dissipate the whole of the oil. Heated to 250° for some time it turned reddish brown, and a yellowish fatty body was given off and occupied the higher part of the tube. A few drops of the oil smeared upon the upper part of the arm was not vesicating, and occasioned no inconvenient symptoms.

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The distillate, from which the oil had been removed, was strongly acid; it was neutralized with baryta. The barium salt thus obtained treated with dilute sulphuric acid, yielded after agitation with ether a yellow oily principle similar to that which had been separated from the distillate by ether. There appears to have been no plumbagin in this root; it had the usual appearance of the drug as met with in commerce, and when received was quite fresh and moist, and had to be dried before it could be powdered. Further operations upon large quantities of the fresh and dried root will be necessary before the nature of this substance can be determined, for at present the physical properties of the principle, the so-called plumbagin, are not sufficiently well known to enable one to positively assert whether it is odourless or not, while its chemical constitution has not been studied.

Toxicology.— Chevers (*Med. Jurisp.*, p. 252,) refers to two fatal cases of poisoning from the internal administration of the root; one of these was homicidal.

In Madras Plumbago was little used before 1882. In 1882 and 1883, it formed 12 per cent. of the cases in which poison was detected in Class A (Human Cases, Viscera examined); in 1888, two cases in 51 were detected; and in 1889, two in 101. In Class B (Suspected Attempts to Poison); in 1883, one in eight; in 1884, one in eight; in 1885, one in seven; and in 1887, one in two of the poisons detected was plumbago. The drug had variously been administered by sorcerers to persons accused of theft, or as an abortifacient, or as a love potion to women. The symptoms were nausea, vomiting, and burning pain in the throat and inability to pass urine. The affected persons were found to have sore mouths, feeble irregular pulses and cold skins. In Bombay, Dr. Lyon finds plumbago root chiefly used for the purpose of causing abortion. With this object it is sometimes given internally, but is usually employed as a local irritant application to the os uteri, a portion of the root or a twig of the plant being pushed into the vagina and sometimes into the uterus. In some cases the cotton-covered end of an abortion stick is smeared with a paste made from the powdered roots.

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The following table shows the particulars of Plumbago poisoning in India :—

Presidency.	Year.	Human Viscera. Plumbagin.	Substances suspected to be or to contain poison.		REMARKS.
			Plumbagin.	Plumbago root or Lalchitra.	
Bengal	1882	2	......	1	"In two stomachs examined in connection with abortion cases, evidence was obtained of the presence of *Plumbagin*, the active principle of *Plumbago rosea* (Lalchitra). According to Norman Chever's Manual of Medical Jurisprudence for India in some ascertained cases *lalchitra* has been given internally as an abortive. As a rule, however, the root is applied either to the neck of the uterus or introduced into the vagina. Chevers also records two instances in which men were poisoned by the drug."
Do.	1884	......	......	2	"*Plumbago rosea* was found in connection with two cases of alleged criminal abortion, one of the cases occurring at Dacca and the other at Ghattal. This plant is extensively used in producing criminal abortion. A piece about 6 inches in length is introduced into the os uteri and there produces intense irritation and vesication which results in abortion when the woman is pregnant. In 1882-83, however, this drug was found in the stomachs of two women, who were alleged to have died from the effects of abortion."

Presidency.	Year.	Human Viscera. Plumbagin.	Substances suspected to be or to contain poison.		Remarks.
			Plumbagin.	Plumbago root or Lalchitra.	
Bengal	1885	......	......	1	
Do.	1886	......	......	1	
Do.	1887	......	......	2	
Do.	1888	......	......	2	
Do.	1889	......	......	1	
Madras	1881	......	......	1	
Do.	1882	1	......	4	"As this poison has very seldom been detected in this Presidency, all of the cases of poisoning by Plumbago are briefly noticed." "In the first case a woman was suspected to have been drugged, in order to facilitate robbing her, by something given in rice flour. The poison was detected in the vomited matter, and also in a suspected powder. The woman seems to have suffered severely, but fortunately had the benefit of skilful treatment, from the Medical Officer, Satur, from whom a careful and intelligent record of the symptoms of the case was received." "In the second case an insane man was reported to have died suffering from vomiting and purging shortly after taking a red powder given him by a native doctor.

Do.	..	......	......	......	A small quantity of Plumbago was found to be present in a suspected powder received for examination. But the proportion of Plumbago to comparatively inert constituents was not so great as to prohibit the possibility of the powder having been a *boná fide* medicine. No traces of poison could be detected in two lots of sand believed to contain vomited matters, or on the soiled cloth worn by the deceased, or in the stomach." "In the third case a man was reported to have died shortly after taking some medicine. Symptoms were briefly described as purging and vomiting." "Plumbago was detected in the viscera and in a suspected medicine. The case seems very similar to the preceding one. In the fourth and fifth cases, which were simultaneously received from Cuddapah, it appeared that in each instance medicine had been taken from an old woman for the cure of venereal disease. In one of these cases, it was alleged that the old woman had been bribed by a rival bazaar man to give a fatal dose. In both these cases, poison was detected in the vomited matter and unexpended medicine. Whatever the true history of the cases may have been, there seems no doubt that the patients were very nearly killed."
Do	1883	18	......	......	The report in 1883 reviews the work of 1882 and a part of 1883; after this it was changed from the official to the calendar year. In the report for 1884, when reviewing the work for 1883, it is mentioned that in examining the human viscera or evacuations for poisons, *Plumbago zeylanica* was detected in 18 instances and one in Class B.

Presidency.	Year.	Human Viscera. Plumbagin.	Substance suspected to be or to contain poison.		Remarks.
			Plumbagin.	Plumbago root or Lalchitra.	
Madras—*contd.* ...	1884	......	......	......	"Plumbago (*Plumbago rosea* or *zeylanica*) was found in one case. It was believed to have been used as an abortifacient."
Do.	1886	......	1	......	A love potion given to a woman was found to contain this poison.
Do.	1887	2	......	......	One given as a purgative medicine.
Do.	1889	2	......	......	One given as an abortifacient.
Bombay	1875	......	1	......	"In another case of the same kind some pills were found to contain a vegetable principle, resembling in characters Plumbagin, the active principle of *Plumbago rosea* or Lalchitra."
Do.	1881	......	3	......	"1, A case from Bijapur, in which some pieces of root alleged to have been used for the purpose of procuring abortion were identified as pieces of the root of the *Plumbago zeylanica*; 2, a case from Sangamner, in which some pieces of stick stated to have been used for the purpose of procuring abortion, were found to be armed at the end with cotton covered with a paste in which, on chemical examination, Plumbagin, the characteristic principle of *Plumbago rosea* and *zeylanica*, was detected; 3, a case from Nasik, in which again Plumbagin was detected in a red paste, and also in matters

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					staining a piece of cloth found in the house of a woman accused of an attempt to procure abortion."
Do.	1885	......	1	......	"In a case from Satara of death after abortion, Plumbagin, the characteristic principle of *Plumbago rosea* and *zeylanica*, was detected in a lump of paste found lying in the vagina of the deceased. In this case arsenic was also detected in minute quantity in the liver."
Do.	1888	......	1	......	"A case from Pandharpur (Sholapore District), in which some drugs found on searching the house of a reputed sorcerer were forwarded for examination. The man was accused of administering a narcotic drug to a woman, in order, it was said, that while under its influence, she might give a clue to the offender in a case of theft. From the symptoms, the drug administered was probably datura. The drugs forwarded were some roots and powders. Of these the roots were found to be Plumbago roots, and a number of the powders were found to contain Plumbagin and a mercurial compound."
N. W. P.	No case recorded.				
Punjab	No case recorded.*				

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* The following case of the use of Plumbago is recorded in Dr. Brown's book on "Punjab Poisons" Case.—*Transactions of the Medical and Physical Society*, Bombay, paper read by Dr. J. Mill :—

On December 16th, 1861, a man poured over the face of a sleeping native, with whom he had quarrelled, a liquid, said to have been prepared from the roots of *Plumbago rosea* and *Semecarpus Anacardium*, but this also contained some blistering flies and sulphate of copper. Six days afterwards he was seen by Dr. Mill, who described the whole of the face, neck and left side of the chest as being covered by a deep black slough, the pain was very great: the next day the slough separated and the man appeared better, but 35 days after the injury, he died from exhaustion."

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Commerce.—The root is sold at Rs. 4 to 5 per maund of $37\frac{1}{2}$ lbs. The Bombay market is supplied from Kattiavar and Guzerat, where the shrub grows to a much larger size than it does in the Concan.

PRIMULACEÆ.

DIONYSIA DIAPENSIÆFOLIA, *Boiss.*

Fig.—*Clusius Exot. i. p.* 199.

Hab.—Persia. The plant.

Vernacular.—Hamáma (*Arab., Ind. Bazars*).

History, Uses, &c.—The recent discovery by Mr. E. M. Holmes of the botanical source of Hamáma (*Pharm. Journ.*, 1887,) enables us better to understand the description by Dioscorides of the *amomon* of the Greeks. His chapter περὶ ἀμώμου has always puzzled the commentators; it has an hiatus in the middle; there are several doubtful readings in the text, and a paragraph which appears to have got into it by mistake. In the edition of 1529 we read φύλλα δε βρυονια (*sic.*) ὅμοια and in the same edition, where bryony is treated of, the word is printed βρυωνία in the usual manner. This creates a suspicion that the true text may have had moss, and not bryony; we can then read the description of the first kind of amomon as follows—"Amomon is a small shrubby plant (θαμνίσκος) like a bunch of intertwining woody stems; it has a small flower like the wallflower (λευκόιον); the leaves are like those of moss; the best is the Armenian, of a golden tinge, with reddish yellow stems, sufficiently fragrant. This would agree very well with the characters of the genus Dionysia. Dioscorides then proceeds to describe the kind found in Media, differing somewhat from the first, and smelling like *peganon.* So far the Arabian version is much the same as the Greek text, but it omits the next paragraph from τον δε πόντικον to 'υπερυθρον, where the hiatus occurs, and begins the description of the third kind thus—"A third kind is the Coptic," &c., evidently quite a different drug from the first two.

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Throughout the remainder of the chapter the Greek and the Arabian versions agree, with the exception that the latter omits all mention of *Amomis*.

The conclusion of the chapter in Dioscorides is noteworthy; he says—"In the selection of these articles it is important to avoid broken pieces, and to choose such specimens as have entire branches springing from a single root;" this is applicable to hamáma, but not to cardamoms.

Theophrastus (9, 7, 1) merely mentions cardamomon and amomon as coming from Media. Celsus (*lib.* V.) mentions amomum and cardamomum as ingredients in a "Malagma adjecur dolens." Pliny (13, 1,) speaks of amomum as an Assyrian shrub with a white flower, from which a costly perfume was made. In short there is no medical description of the drug except by Dioscorides.

The non-medical classical writers mention amomum, but they allude to it in a vague way, or as a precious perfume.

In Virgil's third *Eclogue*, Damœtas says:—

> "Qui te, Pollio, amat, veniat, quo te quoque gaudet:
> Mella fluant illi, ferat et rubus asper amomum."

Among the Arabians Ibn Sina (Avicenna) only notices one kind of Hamámá, "Shajrat kánkood min khashab mushabbak" (a plant with latticed woody branches, the first kind of Dioscorides); but he remarks that it affords a sticky exudation. Sheik Dawood of Antioch, who wrote A. D. 1656, says: "Hamámá, is in Greek amomiya, and its flowers are called leukáin, it is not *bruwaniya*, which is a name for *fashara*. The plant consists of sticks latticed together in a bunch of a reddish-golden colour, acrid, hot, perfumed; it springs from a single root, hard, perfumed; it grows in Armenia and Tarsus, and a kind of it in Syria is greenish and small, or yellowish and fragile, both spurious; and it grows in the month of Nisan (April); it has reddish flowers, like those of the Wallflower or Sádaj."

The Persian writers give similar descriptions, but that of Haji Zein el Attar (A. D. 1368) is more original. He says:—"Hámámá, amámún or amúman in Persian *Mahilú*, hot and

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dry in the second and some say in the third degree. It is of two kinds, one is well-known, and is called in Shiraz mahilu, and there is another kind like *Persiawashán* (maiden-hair), and like it, of a reddish yellow colour; the leaves are green and small, and the flowers yellow and small, and the plant is about a span high, or in my experience less. It grows on stones. The best is of a golden colour from Armenia, and has a sweet smell."

Mr. E. M. Holmes has found in the Herbarium of the British Museum a specimen of *Dionysia diapensiæfolia*, Boiss, bearing an inscription in the handwriting of Kotschy, which states that the plant grows on stones, as stated by Haji Zein. He has also ascertained that the Persian drug is aromatic; possibly Armenia may furnish a more perfumed plant belonging to the same genus. We see nothing in the description of Dioscorides to connect Amomon with Cardamomon. On the other hand, his description of Cardamomon is very short, and such as he would naturally give of an article so well known as this must have been from its every-day employment by Asiatics as a masticatory and spice. In addition to this, he notices a use of cardamoms peculiar to India, namely, as a lithontriptic in nephritis and dysuria. The description of Dioscorides is as follows:—"Cardamomon is brought from Commagene (the northern province of Syria, now Camosh), Armenia, and the Bosphorus, but it is produced also in India and Arabia. Choose that which is tough, well-filled, closed; if not in this state, it is too old and has lost its aroma. The taste is pungent and somewhat bitter.

We think there can be no doubt that the Greeks were well acquainted with Cardamons through their intercourse with Eastern nations long before the time of Dioscorides, although they had no exact information as to their source. As suggested by Mr. Holmes, the *Amomis* of Dioscorides was probably a plant having the same characters as his true amomum.

The Pontic and Coptic kinds were probably entirely different plants used as substitutes. We must also bear in mind that

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plants having no very remarkable properties were used by the ancients, and are still used in the East, as ingredients in perfumes, &c., from some superstitious fancy in connection with them.

The Hamama now in use in the East was known in Europe as Amomum in the 14th and 15th centuries, and is figured by Clusius (*Exot. Lib.* I., p. 199). He calls it *Amomum spurium.* The same drug was found in use in Egypt by Prosper Alpinus, 1580-83. Dr. Leonhart Rauwolff, who travelled in the East (1573-76) for the purpose of studying the drugs of Dioscorides, says of Amomum: "Lastly amongst the rest I did also enquire after the amomum and thought, because they were near unto the confines of Armenia (*i. e.*, the bazars of Aleppo), that therefore they might easily have it by the caravans which come daily from those parts, yet I was forced to run a great while after it, till at length I got a little stock thereof in one shop. They call it by the name of Hamama. But of the other so-called by Dioscorides, which is like unto it, and therefore may easily be taken for the right one, they had a great deal. These two small shrubs, although they are very like to one another, yet for all that they may be distinguished by their stalks and different colours, wherefore Dioscorides bids us (if we will not be imposed upon) to pick out the bigger and smoother, with its noble seed, and to leave the small. This stalk which I found about the length of a finger, is almost of the colour of the bark of the cinnamon tree, and also in its acrimony and good odour (although it was old) still very strong. At the top had been several woody stalks close to one another, whereon I believe had been the flowers and seeds. But the twigs of the other sort, which are crooked and bended, are of a brown colour, which at the top divide themselves into other less ones like a tree, whereon grow several stalks, with little heads like unto the Masaron, or *Marum Syriacum* from Crete, wherein is no great strength nor odour." (*Ray's Collection of Curious Travels and Voyages,* 1693, *quoted by C. C. Bell in a letter to the Pharm. Journ., Jan. 28th,* 1888.)

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Hamama is applied as a poultice to boils and scorpion stings, &c. Taken internally it is considered sedative and is thought to promote the action of the liver and spleen and to remove obstructions in those organs. It is also prescribed in gout and in uterine obstructions, both internally and externally. The dose is 2 dirhems.

Description.—The following is Boissier's description of the plant (*Diag. Ser.* 17, *p.* 65) :—Densissime et late cæspitosa, ramis ob folia vetusta dense imbricata columnaribus ; foliis minute hirto-glandulosis, planis, sub-flabellatim reticulato-venosis, ovatis et oblongo-spathulatis, basi attenuatis obtusissimis, integris vel obtuse utrinque 1—2 crenatis ; pedunculis subnullis, rosulæ foliis occultatis vel paulo longioribus, breviter exsertis ; 1 rarius 2—3, floris, floribus involucro 3—5 bracteato suffultis ; bracteis lineari-spathulatis, obtusis, integris, calycem æquantibus ; calyces ad $\frac{3}{4}$-partiti, laciniis lineari-spathulatis obtusis, corollae luteæ glanduloso-hirtæ, tubo calyce quadruplo longiore, limbi ampli laciniis ovatis retusis. Cœpites lati, 3—4 pollices elati, folia $1\frac{1}{2}$—2 lineas longa, calyx $2\frac{1}{2}$ lineas, corolla 10—12 longa.

Pedunculis exsertis et involucro affinis *D. cæspitosæ*, sed in hac pedunculus longus, bracteæ majores incisæ, calycis laciniæ acutæ, corollæ limbus minor.

The seeds of Hamama are elliptic or subtriangular, concave on the outer side and bluntly keeled on the other; brown in colour, and rugulose with netted markings. The average length $\frac{5}{10}$th of an inch.

Chemical composition.—The plant contains a light brown resin, which becomes covered with a glaucous film on exposure to the air; it is soluble in sulphuric acid and in aqueous alkaline solutions with an orange colour. The taste is at first pungent and warming, afterwards acrid, with a sialogague action. A crystalline body is separated from the alcoholic extract, soluble in water, and responding to alkaloidal tests, but otherwise acting as a neutral substance. Some tree fatty acids are also removed by alcohol from the plant. The seeds examined separately yielded to ether 24 per cent. of brown fat, melting at 29° C. This fat on saponification yields some fragrant volatile fatty acid; a mixture of insoluble fatty acids melting at 41°, soluble in spirit and crystalline; and a neutral, brown, fluorescent resin.

No substance like cyclamin was found in the infusion of the whole herb. The seeds contained ammonia from the decomposition of the albuminoids. The herb afforded 16·9 per cent., and the seeds 11·1 per cent. of mineral matter.

ANAGALLIS ARVENSIS, *Linn.*

Fig.—*Eng. Bot. viii. t.* 529; *xxvi, t.* 1823. Scarlet Pimpernel (*Eng.*), Mouron rouge (*Fr.*).

Hab.— Many parts of India, Europe, Western Asia. The herb.

Vernacular.— Jonk-mári, Jainghani (*Hind.*).

History, Uses, &c.— Dioscorides describes two kinds of ἀναγαλλὶς, the male with red flowers, and the female with blue flowers. According to him the herb has lenitive properties, and is used to subdue inflammation, to assist in the extraction of thorns from the flesh, and in the cure of sores. The juice administered through the nostrils is said to remove pituitous matters from the head and relieve toothache; mixed with honey it removes films from the eyes and improves the sight. Given with wine, it was thought to be an antidote for the poison of the viper; it was also prescribed to relieve pain in the kidneys and liver, and to promote the dispersion of dropsical swellings.

The female plant was supposed to cure *prolapsus ani* and the male plant to incite that disease. Pliny (25, 92) speaks of the plant to the same effect. The Arabian and Persian physicians repeat the words of Dioscorides with slight additions or variations, but remark that large doses have an injurious effect upon the stomach; they call the plant Anághális, but in modern Arabic it is known as Marijáneh. The old European physicians recommended the use of Anagallis in mania and melan-

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choly, and Quercitanus made it a speciality in his treatment of mania. Ravenstein and Gwelin record cases in which persons bitten by rabid animals were cured by the use of this herb; it was administered internally and also applied to the bitten part.

Most of these physicians considered it to be an efficacious remedy in gout, dropsy, and pulmonary complaints. Orfila places Anagallis among the narcotico-acrids, and gives the following account of its effects upon animals:—"At eight in the morning three drachms of the extract of pimpernel, prepared by evaporating in a water-bath the juice of the fresh plant, were introduced into the stomach of a robust dog. At six in the evening he was dejected, and at eleven sensibility appeared diminished. The next morning, at six, he was lying down, apparently dead, and might be displaced like a mass of inert matter. He expired half an hour after. The mucous membrane of the stomach was slightly inflamed; the interior of the rectum was of a bright red colour; the ventricles of the heart were distended by black coagulated blood; the lungs presented several livid spots, and their texture was preternaturally dense. Two drachms of the same extract, applied to the cellular tissue of a dog's thigh, caused death in twelve hours with the same symptoms as the preceding. M. Gronier gave to horses some tolerably strong doses of the decoction of this plant, and he observed almost constantly a trembling of the muscles of the posterior extremities as well as those of the throat, and a copious flow of urine. After death the mucous membrane of the stomach was found inflamed."

In India, Anagallis is used as a fish-poison, and also to kill leeches, which sometimes get lodged in the nostrils of those who frequent the jungles in the rainy season. Both the blue and the red flowered varieties are found in Western India; the blue being the common one eastward.

Description.—Root small, stem branched from the lower part, often dotted with purple, more or less procumbent, square. Leaves sessile, ovate, many-ribbed, dotted with purple at the back. Peduncles angular, longer than the leaves,

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twisted and recurved after flowering. Corolla bright scarlet, with a violet coloured mouth; its edges finely crenate, or minutely fringed with glands. Fruit pale and transparent, the size of a pea. Seeds roughish. The plant has a somewhat bitter and acrid taste.

Chemical composition.—D. Malapert (1857) has shown that the poisonous properties of the plant are due to the presence of a substance similar to, if not identical with, *Saponin.* J. A. Heintzelman obtained a small quantity of volatile oil from the dry herb, and found it of a strong peculiar odour and a pungent and acid taste. A few drops produced headache and nausea lasting for several hours.

CYCLAMEN PERSICUM, *Miller.*

Fig.—*Bot. Mag.*, *t.* 44. Sow-bread (*Eng.*), Arthanite, Pain de pourceau (*Fr.*)

Hab.—Persia. Levant. The tubers.

Vernacular.—Bakhúr-i-Miryam (*Ind. Bazars*).

History, Uses, &c.—Under the name of κυκλάμινος, a species of Cyclamen is mentioned by Greek medical writers, which Fée considers to have been *C. hederæfolium*, Ait., and Littré *C. græcum*, Lam.: it was also called ἰχθυόθηρον, "fish-taker," from its being used to kill fish, and according to Theophrastus was used as a love charm. It is described as having emetic, purgative and hydrogogue properties, and was considered to be useful as an emmenagogue, as an antidote to the poison of snakes, and when locally applied, as a resolvent of tumours. The juice was blown into the nose to purge the brain; mixed with wine it is said to have intoxicating properties. The plant was supposed to cause pregnant women to abort if they walked over it, and the dried root was worn by men as an amulet to protect them against spells. Pliny (25, 67) calls it Cyclaminos, and states that it is known in Italy as *Tuber terræ;* he repeats much of what Dioscorides says about its medicinal properties. The Arabian physicians under the

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names of Artanitha and Bakhúr Miryam reproduce what Dioscorides has written concerning Cyclamen. Persian writers describe the Persian plant under the names of Azarbu and Chubak-ushnán, and state that it is a kind of Artanitha. The Indian Mahometan writers follow the Arabs and Persians. The different species of Cyclamen were formerly used in Europe on account of their emetic, purgative, and diuretic properties, and an ointment prepared from the root was applied to the abdomen of adults to produce vomiting or purging, and over the bladder to induce diuresis; it was also applied to the navel of children suffering from intestinal worms, and to scrofulous tumours. Bulliard states that it is still used in the north of France as a purgative and often produces emesis, cold sweats, giddiness and convulsive movements. Pigs are said to eat the root with impunity, but fish are easily poisoned by it, and frogs sicken and die after a few days. Schroff, who has experimented with cyclamin, comes to the following conclusions:—1, Cyclamin does not act upon the sound skin; 2, in the mouth it produces a very unpleasant sensation and taste, and excites salivation; 3, in the stomach it causes burning, oppression, nausea, and vomiting, and in this organ, as in the intestine, it occasions inflammation; 4, in the connective tissue it excites inflammation, which may be followed by gangrene: 5, it does not affect the brain, spinal marrow, or nerves; 6, it salivates men when not taken by the mouth, but by the veins; 7, its action is analogous to that of saponin. (*Stillé and Maisch.*)

Description.—These plants have a roundish, tuberous, or fleshy root stock, from the upper side of which spring the leaves and flowers, sometimes directly from the top, sometimes from a short neck-like stem. The leaves are roundish or ovate with a deep basal sinus, sometimes angular at the margins and often marbled with greyish white. The flowers have the segments of the corolla turned back. The capsule is five-valved, and after flowering the scape in most of the species coils up spirally with the seed vessel in the centre, bending itself at the same time towards the ground. Porta considers that the root "suo circinato bulbo muliebrem uterum affabre demonstrat effigiatum."

Chemical composition.—The activity of the plant depends upon a principle similar to, if not identical with, saponin. Saladin (1830) named it cyclamin. It has a bitter acrid taste, forms a soapy mixture with water, and when boiled with acids is converted into glucose and a resinous substance which has been named cyclamiretin. Fish poisoned by it die asphyxiated through imperfect respiration. (*Gmelin*, 15, 343; 16, 200.)

MYRSINEÆ.

EMBELIA RIBES, *Burm.*

Fig.—*Burm. Fl. Ind.*, *t.* 23; *Lam. Ill.*, *t.* 133.

Hab.—Throughout India. The berries.

Vernacular.—Viranga, Váyvirang, Bábirang (*Hind.*), Biranga (*Beng.*), Vávadinga (*Mar.*), Váyvirang (*Guz.*), Váyu-vilangam (*Tam.*, *Tel.*), Vâyubilaga (*Can.*).

History, Uses, &c.—The Sanskrit name is Vidanga; it has many synonyms, such as Vrisha-násana, "destroyer of the enemy" (worm); Suchitra-vija and Chitra-tandula, "having variegated seeds." Susruta describes the fruit as anthelmintic, alterative and tonic, and recommends its use along with liquorice root for the purpose of strengthening the body and preventing the effects of age. In the Nighantas it is described as bitter, pungent, hot, astringent, appetizing and light; useful for the removal of abdominal pains, worms, wind and skin diseases. The berries enter into the composition of several applications for ringworm and other skin diseases.

Under the names of Birang-i-Kabulí and Biranj-i-Kabulí notices of the drug will be found in Mahometan works. The hakíms consider it to be attenuant and a purgative of phlegmatic humours; also a valuable anthelmintic, especially against tapeworms. Ibn Sina describes it as a strong anthel-

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mintic. Mír Muhammad Husain notices that it turns the urine red. He fixes the dose at three dirhems of the powder, and directs it to be given with fresh milk. Rheede figures a plant which appears to be *Embelia robusta*, and states that the seeds kill worms. Ainslie has the following short notice of it:—"Babreng is the Hindooie name of a vermifuge seed, common, I have been given to understand, in the higher provinces of Bengal, the Sanskrit name of which is Chitratandoola. What the plant is I know not." Roxburgh gives a full botanical description of the plant, and remarks that the berries are used to adulterate pepper. Royle notices their aperient properties. Váyvirang is in high repute as an anthelmintic among the country people, especially in cases of tapeworm, a disorder common among the Native Christians of the Coast. The dose is a teaspoonful of the powder twice a day for a child, and a dessertspoonful for an adult; it can hardly be called purgative; the taste is rather pleasant, slightly astringent, and faintly aromatic. The worm is expelled dead. A purgative should be given to prepare the patient for the drug. It is a common practice to put a few berries of this plant in the milk that is given to young children; they are supposed to prevent flatulence.

Recently Dr. Harris (*Lancet, July 23rd,* 1887) has directed attention to the value of this drug as a remedy for tapeworm. He states that he has administered it for several years with good results to natives of India and Europeans; he gives one to four drachms with milk and curds early in the morning.

Description.—The fruit is globular, of a dull red, and grows in large bunches; it is rather smaller than a peppercorn. The dried fruit has the five partite calyx and stalk often attached; the outer shell is striated from the base to the apex, where there is a small beak; its colour is reddish brown, marked with dark spots; inside the outer shell is the seed, enveloped in a delicate membrane, on removing which a cup-like hollow is seen opposite the insertion of the stalk. The seed is horny, of a reddish colour, and its external surface appears to be covered with spots of white mildew: this appearance however, with the aid of a lens, is seen to be due to a delicate crystalline efflorescence. If kept for any time the outer shell of the fruit becomes much darker. From the rapidity with which this change takes place, we would suppose the quality of the drug to be not affected by it.

Chemical composition.—Warden (*Pharm. Journ., Jan.* 1888) separated from the fruit a substance in the form of brilliant golden spangles having the properties of an acid, which, with caustic soda, potash and ammonia, gave wine-red solutions.

He obtained crystalline compounds of this acid with soda, potash and ammonia, and provisionally named it *Embelic acid.* In a further communication to the same Journal (*Oct.* 20*th*, 1888), he says:—"The embelic acid used for ultimate analysis was repeatedly crystallized from absolute alcohol, and the soft crystalline mass thus obtained strongly pressed between layers of cloth to remove mother-liquor. The resulting cake was freed from alcohol by exposure to air, reduced to powder, and finally dried at 100° C. in the water oven for some hours.

On combustion with cupric oxide in a current of oxygen in an open tube, the following results were obtained:—

A—·2696 gram gave ·6920 gram CO^2 and ·2308 gram H^2O.
B—·2534 ,, ·6506 ,, ,, ·2106 ,, H^2O.

From these figures the following percentage composition is deduced:—

	Carbon.	Hydrogen.	Oxygen.
A	70·000	9·495	20·405
B	70·019	9·234	20·747
Mean	70·009	9·364	20·627

These percentages lead to the formula $C^9H^{14}O^2$, as is seen by the following comparison:—

		Theory.		Found.
9	equiv. of carbon	108	70·129	70·009
14	,, hydrogen............	14	9·090	9·364
9	,, oxygen...............	32	20·781	20·627
		154	100·000	100·000

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In order to determine the molecular formula, compounds of silver and lead with embelic acid were examined. In preparing the metallic salts of embelic acid, as the acid is insoluble in water, alcoholic solutions neutralized with ammonia—any excess of ammonia being driven off by prolonged boiling—were mixed with hot alcoholic solutions of silver and lead. The resulting precipitates were allowed to subside, washed with water by decantation, thrown on a filter and washed with alcohol, then with ether, thirdly with water, and finally again with alcohol and ether. The precipitates were very difficult to wash, owing to caking, and during the operation a certain amount of decomposition appeared to occur. Thus, in preparing the lead and silver salts, after mixing the solution of embelic acid with an excess of the metallic solution, the supernatant liquid, when the precipitate had subsided, was colourless; but on washing the precipitate with alcohol and ether, the filtrate was coloured yellow, and after prolonged washing with water, the filtrates afforded evidence of the presence of silver or lead, and then when alcohol and ether were used for the final rinsings the filtrates were again coloured yellow.

Ignition of the silver salt, after having been dried at 100° C., indicated that it contained 40·653 per cent. of the metal, which gives 264·9 as the molecular weight of the salt, and 158 as the molecular weight of the acid, the acid being represented by the formula $HC^9H^{15}O^2$. The silver salt would have the formula $AgC^9H^{15}O^2$, which requires the following theoretical percentage:—

Carbon	41·432
Hydrogen	4·987
Silver	41·302
Oxygen	12·279

The composition of the salt as determined by analysis afforded the following percentages:—

Carbon	41·544
Hydrogen	5·557
Silver	40·653
Oxygen	12·246

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Two analyses of the lead salt afforded 37·781 and 37·810 per cent. of lead, respectively, which gives a mean percentage of 37·795 as the lead content of the salt. Taking the lead salt to be represented by the formula $(C^9H^{13}O^2)^2Pb''$, its theoretical percentage composition would be—

Carbon	42·154
Hydrogen	5·074
Lead	40·282
Oxygen	12·490

while the actual percentage as determined by analysis gave the following figures :—

Carbon	43·545
Hydrogen	5·824
Lead	37·795
Oxygen	12·836

A comparison of the theoretical and found percentages for the silver and lead salts indicates differences which can only be accounted for by assuming that the salts were partially decomposed during preparation.

Embelic acid was found to have a melting point of 139·5° C. to 140° C. (uncorrected), when it forms a deep ruby liquid. At about 155° C. it commences to decompose; indications of a portion having sublimed were noted.

The following colour reactions were obtained by adding the respective re-agents to dilute alcoholic solutions of the acid :—

Ferric chloride, a dirty brownish-red colour.

Ferrous sulphate, brownish colour.

Chloride of zinc, violet colour.

Phosphomolybdic acid, light green precipitate.

Plumbic acetate, dirty green precipitate.

Nitrate of silver, dirty reddish-brown precipitate.

Embelic acid is insoluble in water, and is not decomposed by being boiled with dilute sulphuric or hydrochloric acid.

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Salts of embelic acid with soda, potash and ammonia were prepared. The ammonia salt was the one most readily obtained crystalline. When an alcoholic solution of embelic acid was mixed with strong ammonia in excess, and the deep red resulting liquid allowed to evaporate spontaneously, the salt crystallized in large needle-shaped crystals of a foxy red hue.

The ammonium salt was found to be effective as an anthelmintic for tænia in doses of 3 grains for children and 6 grains or more for adults. It would appear to act in cases in which the ordinary tæniacides fail. The best method of administration is to give the salt with a little honey or simple syrup, the drug being preceded and followed by castor oil. The ammonium salt of embelic acid possesses one very important advantage over the liquid extract of male fern—it is tasteless—and may thus prove a useful addition to our materia medica.

Lascelles Scott has found in the fruit a minute quantity of volatile oil with a spicy flavour, a fixed oil, colouring matters, a resinoid body, an alkaloid of a yellowish white colour, which he has named *Christembine,* and a tannin. The dried fruit as sold in the Calcutta bazars is generally mixed with pepper corns, and the volatile oil mentioned by Scott may be due to this admixture.

Commerce.—The fruit of *E. robusta* is collected and sold under the same name as that of *E. Ribes.* Moodeen Sheriff has observed two varieties of the drug offered for sale in Madras. The drug has lately been exported to Germany to some extent. Value, Rs. 2½ per maund of 37½ lbs.

SAPOTACEÆ.

BASSIA LATIFOLIA, *Roxb.*

Fig.—*Roxb. Cor. Pl., t.* 19; *Bedd. Fl. Sylv., t.* 41.

Hab.—Central India, W. Bengal to Western Ghâts, Kumaon, Terai.

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BASSIA LONGIFOLIA, *Linn.*

Fig.—*Wight Ill., t.* 147; *Bedd. Fl. Sylv., t.* 42.

Hab.—Malabar Coast, Ceylon. The flowers and oil of the seeds.

Vernacular.—Moha (*Hind., Mar.*), Maua (*Beng.*), Mahudo (*Guz.*), Illupai (*Tam.*), Ippa-chettu (*Tel.*), Ippa-gida (*Can.*). *B. latifolia* is sometimes distinguished by the addition of the adjective "wild" or "forest."

BASSIA BUTYRACEA, *Roxb.*

Fig.—*Roxb. in Asiatic Researches*, viii. *p.* 499—502. Indian butter tree (*Eng.*).

Hab.—Sub-tropical Himalaya. The oil of the seeds.

Vernacular.—Phúlwára, Chiára, Cheuli, Cheuri (*Hind.*), Yelpot (*Lepcha.*).

History, Uses, &c.—These trees are called in Sanskrit Madhuka, Madhudruma, "honey tree," Madhupushpa, "honey flower," Madhusakha, Madhusravas, Gudapushpa "sugar flower," and Kolaphala, or "the fruit of the Kols," a wild tribe inhabiting the hills and forests of Central India, who subsist, to a great extent, upon the fleshy flowers which they collect and dry. The milky juice of the bark, Madhuka-sára, is described as a remedy for phlegm and rheumatism, astringent and a promoter of suppuration; the flowers as sweet, strengthening and cooling; the fruit as cold, sweet and strengthening; it is thought to be antibilious and anti-rheumatic, and useful in leprosy and skin diseases. The spirituous liquor prepared from the flowers is called Madhu-mádhavi or Madhvásava, and is described by Susruta as heating, astringent, tonic and appetizing. The flowers, seeds and oil obtained from them, are more or less used as food all over India, and in many districts form a very important addition to the dietary of the agricultural classes. For further information upon this subject we

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would refer our readers to "The Dictionary of Economic Products of India," by Watt (Vol. I., p. 405—416). Ibn Batuta, who visited India A.D. 1332, mentions مهوى (Mahwa), and remarks that the flowers, when dried in the sun, taste like figs. The Persians have named these trees *Darakht-i-gul-chakán* on account of their deciduous flowers. In Guzerat the Mahometans manufacture a coarse soap from the oil of the seeds with soda and lime; this soap varies in price according to the amount of oil it contains. Medicinally, Bassia oil is used as an emollient application to the skin, and the cake as a detergent for washing the hair, and also as an emetic. The oil of *B. butyracea*, known as *Phúlwa butter*, may be used in the preparation of *Ung. Hydrarg. Nitratis* in the same manner as Kokam butter (See *Garcinia indica*). The bark of the Bassias is used in decoction as an astringent. From the flowers a coarse kind of molasses may be prepared. Bassia spirit when rectified loses its offensive odour, and may be used for pharmaceutical purposes. The ordinary native distilled spirit is very rich in fusel oil: one of us found as much as ·4 per cent. in a sample of Mahwa spirit. In the Bengal districts in which the spirit is made, the fermentation is conducted in earthen vessels containing 10 to 20 gallons of fluid, 10 to 20 seers of the flowers being a charge. The jar is then filled up with spirit wash and water, and the process of fermentation occupies from 3 to 7 days, depending on the temperature. The stills are of the rudest description. Molasses and other materials are sometimes added to the contents of the vats. The amount of spirit obtained varies with the quality of the flowers: Warden's experiments would indicate that on an average one maund will yield about 2·12 gallons of London proof spirit when treated in the manner usual among native distillers. In some districts a composition called *bakha* or *muli* is added to the contents of the fermenting vats; it is stated to be composed of herbs and roots, which are dried, ground, and made up into balls with flour. About half a seer (1 lb.) is added to one maund (80 lbs.) of raw material. In certain cases dhatura, nux vomica seeds and other poisonous substances are added to these balls.

The use of bakha has been prohibited in Government distilleries in Calcutta and its suburbs. For further information on Mahwa spirit, we would refer the reader to the report of the Commission of 1883-84 on the excise of country spirit in Bengal. A kind of gutta-percha has been prepared from the milky juice of *B. latifolia*, which has the consistence of ordinary gutta, but is more adhesive and hardens much more rapidly. Used alone it cannot replace the gutta of commerce, but mixed with an equal proportion of that article, it may be used to make the moulds required in galvanoplastic operations; the mixture is as easily manipulated in hot water as ordinary gutta. (*Heckel and Schlagdenhauffen.*)

Description.—Bassia bark is thick and red coloured, with a rough brown surface and astringent taste. The trees produce cream-coloured flowers in March and April, and in August a reddish-yellow fruit from 1 to 2 inches long, which contains from 1 to 4 seeds; these are light brown, about 1½ inch long and ¾ of an inch broad, irregularly ovoid in shape, with a large scar on one side and a ridge on the other, terminating in two slight prominences; the shell is thin and brittle, and the seed consists of two large oily cotyledons, easily separated, white when fresh, but soon turning brown when kept. They yield a greenish-yellow oil, which becomes a solid white mass in the cold weather; that of *B. butyrace*[illegible]olid at 35° C., whereas the oils of *B. latifolia* and *B. long*[illegible] melt at 25·3° C.

The dried flowers at a little distance have the appearance of raisins, on closer inspection they are seen to be fleshy, sticky, compressed, hollow bodies, about $\frac{6}{10}$ of an inch long, and nearly as broad, with an aperture at both ends, the upper being much the larger and serrated. Upon being soaked in water they assume an almost globular form, and the numerous anthers are seen attached by very short filaments to the inside of the corolla. The taste is acid and sweet. The fleshy substance of the corrolla, which is about $\frac{1}{10}$ of an inch in thickness and translucent, consists of a parenchyma which may be divided

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into two portions: an outer or cortical, consisting of smaller cells, and an inner consisting of large cells; it is traversed by numerous bundles of spiral vessels; some of the cells contain crystalline masses of sugar; all of them granular matter; there is no starch.

The seeds are from 1 to 2 inches long, and enclosed in a chestnut coloured thin shell; they have a peculiar odour and bitter aromatic taste. The latex of these trees is a milky liquid, sticky to the touch, when kept it developes a rancid sour odour; it contains, besides the gutta-percha, some starch and about 88 per cent. of water.

Chemical composition.—Bassia flowers have been examined by Church (1886), who found them to have the following composition:—

Cane sugar	3·2
Inverted sugar	52·6
Other matters sol. in water	7·2
Cellulose	2·4
Albuminous substances	2·2
Ash	4·8
Water at 100° C.	15·0
Undetermined matter	12·6

MM. A. Riche and A. Rémont (*Journ. de Pharm. et de Chim.*, 1880,) found in the flowers of *B. longifolia* 60 per cent. of fermentable sugars and 8·50 per cent. of crystallizable sugar.

In a paper read before the Society of Chemical Industry, 1887, Mr. H. S. Elsworthy gave the composition of trade samples of the flowers of *B. latifolia*:—

	Saccharose.	Invert sugar.	Dextro-glucose.	Total Sugar.
1. Hyderabad	17·1	40·0	...	57·1
2. Jubbulpore	4·6	41·4	...	46·0
3. Guzerat	9·6	45·3	...	54·9
4. Mirzapore	6·7	...	43·6	50·3

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The seeds of *B. longifolia* have been examined by E. Valenta (*Dingl. Polyt. Journ.* ccli., 461). One hundred parts dried at 100° C. gave—

Fat (light petroleum extract)	51·14
Matters soluble in absolute alcohol	78·3
Tannin	2·12
Bitter principle sol. in water	0·60
Starch	0·07
Vegetable mucilage	1·65
Albuminous substances soluble in water	3·60
Extractive substances soluble in water	15·59
Insoluble proteids	4·40
Total ash	2·71
Fibre and loss	10·29
	100·00

Ash in the soluble portion 0·95 per cent.

Total proteids .... 8·00 ,,

For the extraction of the fat, light petroleum boiling at 40°—45° was used. The fat has a yellow colour and greasy consistency; but on exposure to the air and light the colour disappears and the fat soon becomes rancid. It has a specific gravity of 0·9175 at 15°, melts at 25°·3, solidifies at 17°·5—18°·5. It contains considerable quantities of free fatty acids, but only a small amount of glycerol. One gram of the fat requires 192·3 mgrms. of KHO for the complete saponification of the fatty acids. It is partly soluble in alcohol, and perfectly soluble in ether, carbon bisulphide, benzene, &c. The fatty acids obtained by saponifying the fat with potash-ley, and decomposing the resulting soap by means of a ten per cent. solution of hydrochloric acid, have a white colour, and pleasant odour and taste. They melt at 39°·5, solidify at 38°, and dissolve readily in alcohol. According to Schädler the butter consists of 80 per cent. of stearin and 20 per cent. of olein; the author, however, found that it contained palmitin and olein.

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The ash of the seeds is yellowish-white, and dissolves almost completely in water. It gives by analysis—

Silicic acid and portion insoluble in nitric acid	10·67
Phosphoric acid	15·47
Sulphuric acid	6·81
Carbonic anhydride	7·46
Ferric oxide and alumina	2·01
Lime	0·64
Potash with traces of soda	56·68
Moisture and loss	0·26

—(*Year-Book of Pharmacy*, 1886, p. 174.)

According to MM. E. Heckel and F. Schlagdenhauffen (*Journ. de Pharm. et de Chim.*, 1889,) the latex of *B. latifolia* has the following composition :—

Water		87·40
Acid formic (trace) and acid acetic		0·50
Insol. in water 1·666	organic matter	1·405
	ash	0·261
Sol. in water 0·172	tannin and gum	0·125
	ash	0·047
Sol. in alcohol	resin α	2·043
Sol. in acetone	resin β	2·824
Gutta-percha		1·803
Ash		3·792
		100·000

The gutta-percha is flesh-coloured, tolerably hard at ordinary temperatures, but softens when worked with the hand and becomes sticky; dried at 105° C. it loses about 60 per cent. of water; strongly pressed and dried on a water-bath, it becomes light brown, gradually hardens, and becomes covered with a white efflorescence, which dissolves at once in chloroform and bisulphide of carbon, and less easily in cold alcohol. Boiling alcohol and acetone dissolve ⅔ of its weight; the solution filtered whilst hot deposits a grumous mass, without any trace of crystals. The alcohol and acetone solutions when concentrated afford a syrupy, colourless, transparent fluid, which, when completely dry, presents the appearance of gum, and is easily powdered. Concentrated sulphuric acid colours this substance yellow and afterwards brown; the addition of chloroform does not change the colour. On the addition of a trace of ferric chloride to this mixture and allowing it to stand, a rose-coloured upper layer forms, which gradually becomes blue. This reaction much resembles that of cholesterine, but is not due to the presence of that substance. Heated with fuming nitric acid, picric acid is not formed; concentrated hydrochloric acid, caustic potash and fused potash have no action on it. Warmed in a test tube it decomposes slowly and does not yield any crystalline product on cooling. Its formula is $C^8H^{12}O$. The portion insoluble in alcohol and acetone has the consistence of ordinary gutta-percha, but is more adhesive, and hardens much more readily than that substance. On combustion it leaves a white ash consisting of sulphate of lime with a trace of chloride and phosphate of sodium. (*Heckel and Schlagdenhauffen.*)

We find the bark of *B. longifolia* to contain 3 per cent. of caoutchouc, extracted by benzol; 17 per cent. of tannin, extracted by water; and some oxidized tannin removed subsequently by spirit or alkali. The bark contains starch and rhomboid crystals of calcium oxalate, and leaves 9·42 per cent. of ash when burnt.

The bitter principle contained in the seeds is probably saponin.

Commerce.—No definite information concerning the internal trade in the flowers is obtainable, but its value has been estimated at not less than 35 lakhs of rupees. For several years large quantities were exported from Bombay to France. In 1881-82, the exports were 57,000 cwts.; in 1882-83, 68,829 cwts., valued at Rs. 1,61,317; and in 1883-84, 227,114 cwts., valued at Rs. 5,70,879. In 1885 their import into France was prohibited by the French Government, as it was found to materially interfere with French interests.

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The oil and seeds are exported to some extent for candle making. The value of the oil in Europe has been estimated at about £35 per ton.

MIMUSOPS ELENGI, *Linn.*

Fig.—*Wight Ic.*, *t.* 1586; *Bedd. Fl.Sylv.*, *t.* 40.

Hab.—Deccan Peninsula. Cultivated elsewhere. The bark, flowers, fruit, and oil of the seeds.

Vernacular.—Maulsiri (*Hind.*), Ovali (*Mar.*), Bakul (*Beng.*), Bolsiri (*Guz.*), Mogadam (*Tam.*), Pogada-mánu (*Tel.*), Halmadhu (*Can.*), Taindu (*Central Prov.*).

History, Uses, &c.—This highly ornamental tree, with dark green, oblong, alternate leaves and small white fragrant flowers, which turn to a tawny yellow colour before they fall, is very common in gardens in India. It is the Vakula, Kesara and Sinha-kesara, "lion's mane" of Sanskrit writers. Chakradatta mentions the astringent properties of the unripe fruit, and recommends it to be chewed for the purpose of fixing loose teeth. He also mentions a decoction of the astringent bark as a useful gargle in diseases of the gums and teeth. In the Concan a similar use is made of the unripe fruit, and the fruit and flowers along with other astringents are used to prepare a lotion for sores and wounds. Mír Muhammad Husain notices the practice of planting this tree on account of its handsome appearance. He says that the unripe fruit and seeds have powerful astringent properties, and that the decoction of the bark is useful as an astringent in discharges from the mucous membrane of the bladder and urethra, and also as a gargle in relaxation of the gums, &c. He mentions the use of a snuff made from the dried and powdered flowers in a disease called Ahwa, common in Bengal. The symptoms of this disease are strong fever, headache and pain in the neck, shoulders and other parts of the body. The powdered flowers induce a copious defluxion from the nose and relieve the pain in the head. The flowers are much used by the natives on account of

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their perfume, which they retain when dry; pillows are sometimes stuffed with them, and they afford a distilled water. The juice of the bark and unripe fruit is used by silk dyers to fix colours. Rumphius states that the pounded leaves are applied to cure headache, that a decoction of the root is given in angina, whilst a plaster made from them is applied externally. The ripe fruit pounded and mixed with water is given to promote delivery in childbirth. (*Hort. Amb.* III., 17.) Horsfield (*Asiat. Journ.* VII. p. 262) describes the bark as an astringent tonic, and Dr. Bholanauth Bose states that a decoction of it forms a good gargle in salivation. (*Pharm. of India*, p. 131.)

Description.—The substance of the bark is red, it is covered externally by a very thick grey suber on the older branches, which separates in irregular scales, leaving isolated attached portions which consist of five or more distinct suberous layers; the inner surface is red and presents a coarsely striated surface; fracture short, disclosing white specks and stains in the substance of the bark caused by the drying up of the milky juice which it contained when fresh. The taste is bitter, astringent and mucilaginous.

The flowers are white and fragrant; calyx inferior, eight-leaved, in a double series; leaflets lanceolate, the four exterior ones leathery, larger and permanent; corolla one-petalled, tube very short, fleshy, border composed of a double series of segments; the exterior one consists of sixteen, spreading; the interior one of eight, generally contorted, and converging, all are lanceolate, a little torn at their extremities; nectary eight-leaved, conical, ragged, hairy near the base, inserted alternately with the filaments into the mouth of the tube, converging filaments eight, short, hairy; anthers linear, sharp-pointed below, two parted, converging. The berry is oval, smooth, when ripe yellow, and edible, one or more celled, according to the number of seeds that ripen; seed solitary, oblong, compressed, attached to the bottom of the cell, covered with a smooth, hard, thick integument, lined with a veined membrane; perisperm conform to the seed, two-lobed, pointed at the base, the

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lobes uniting round the radicle; above the radicle they are often entirely divided by the large cotyledons, which extend to, or rather through its margins; embryo erect; cotyledons large, oval; plumule minute; radicle inferior, linear oblong. (*Roxburgh.*)

Chemical composition.—A decoction of the bark afforded 20·3 per cent. of extract containing 6·8 per cent. of tannin. Some caoutchouc, wax, colouring matter (probably oxidized tannin), starch, and 9·4 per cent. of ash were also obtained from the bark.

Mimusops hexandra, *Roxb., Cor. Pl. i., t.* 15; *Wight Ic., t.* 1587; a native of the Deccan Peninsula and Ceylon, cultivated in Northern India, has much the same properties as *M. Elengi*. The vernacular names are Kshiri (*Hind.*), Khirkhejur (*Beng.*), Rájana, Kerni (*Mar.*), Ráyan (*Guz.*), Palla *Tam.*).

The Sanskrit name is Rájádani. The dried fruit is known as *Kàkadia* in Guzerat, and the fresh fruit is sold in the streets in Bombay under the name of *Ahmadábádi-mewa.*

It is a handsome tree, with rigid branches and broad wedge-shaped leaves, and is often found planted in groves near Mahometan towns and buildings. The wood is tough, and is much used for making sugar mill beams, well-frames, &c. The ripe fruit is eaten both fresh and dried, and the bark which much resembles that of *M. Elengi* is used medicinally on account of its astringent properties. In the Concan the white milky juice, which exudes when the tree is wounded, is made into a paste with the leaves of *Cassia Fistula* and seeds of *Calophyllum inophyllum,* and applied as a maturant to boils. The seeds yield an oil which, according to Dr. Mootooswamy, is used as a demulcent, emollient, tonic and alterative in South India.

Chemical composition.—The tannin in this bark was identical with that found in the bark of *M. Elengi.* The bark examined was younger and afforded 10·3 per cent. of tannin, giving a greenish precipitate with ferric salts, and 30 per cent. of oxide on the ignition of its lead compound. It contained also a resin, wax, caoutchouc, colouring matter, starch, and 7·5 per cent. of mineral residue.

The fixed oil from the seeds is of a light yellow colour, tasteless and odourless, and solidifies at a temperature a little above 15° C. At 17° it has a specific gravity of ·9186. The saponification equivalent is 266·3, as the oil requires 21·1 per cent. of caustic potash to form a complete combination with it. The oil yields 94·5 per cent. of insoluble fatty acids melting at 37°, and containing some stearic acid.

The fruit juice evaporated by heat leaves a blackish extract or paste having a pleasant flavour and sweetness. The extract contains 70 per cent. of sugar, which answers to levulose or fruit sugar. It also contains a yellow resin soluble in ether, alcohol, and benzol, and some caoutchouc. Pectin, colouring matter and a small quantity of tannin occur in the soluble portion of the juice.

ACHRAS SAPOTA, *Linn.*

Fig.—*Bot. Mag., tt.* 3111—3112; *Gärt. Fruct.* 2, *t.* 104. Sapodilla plum, Bully tree (*Eng.*), Sapotillier (*Fr.*).

Hab.—West Indies. Cultivated in India. The bark, fruit and seeds.

Vernacular.—Chiku (*Mar.*).

History, Uses, &c.—This tree has become completely established as a fruit tree on the Western Coast, and in Bengal, and its fruit is regularly offered for sale in the markets. In other parts of India it appears to be less common. In the West Indies and South America the bark is used as a tonic and febrifuge, and the seeds are used as a diuretic in six grain doses; larger doses are said to be dangerous, and a case of poisoning by them has been recorded by Leprieur. In India the fruit is much esteemed by the natives, who consider that, if soaked in melted butter all night and eaten in the morning, it prevents bilious and febrile attacks. We have not seen the bark or seeds used, nor do the natives appear to have noticed their medicinal properties. The tree yields a kind of gutta-percha similar to that of other sapotaceous plants.

Description.—The bark is red with a grey suberous outer coat; it has a bitter and strongly astringent taste. The fruit is ovoid externally rusty brown and rough, internally yellowish white, soft and pulpy; when quite ripe it has a medlar-like flavour. The seeds are black, shining, ovoid and elongated.

Chemical composition.—Bernou (*L'Union Pharmaceutique*, 1882,) separated from the bark two resins, one of which is soluble in ether, 11·8 per cent. of tannin, and the alkaloid *sapotine*, which is soluble in alcohol, ether, and chloroform, and is precipitated from its salts by ammonia.

EBENACEÆ.

DIOSPYROS EMBRYOPTERIS, *Pers.*

Fig.—*Bot. Reg., t.* 499; *Bedd. Fl. Sylv., t.* 69; *Roxb. Cor. Pl. i., t.* 70; *Rheede Hort. Mal. iii., t.* 41. Indian Persimmon (*Eng.*), Plaqueminier Glutinifère (*Fr.*).

Hab.—Throughout India. The fruit.

Vernacular.—Taindu (*Hind.*), Gáb (*Beng.*), Tumbilik-kay (*Tam.*), Tumiki, Tinduki (*Tel.*), Panich-chi (*Mal.*), Timburni, Temar (*Mar.*), Temru (*Guz.*).

History, Uses, &c.—*D. Embryopteris* is the Tinduka of Sanskrit writers; its bark is described in the Nighantas as a good application to boils and tumours, and the juice of the fresh bark as useful in bilious fever. The fruit when unripe is said to be cold, light, and astringent, and when ripe beneficial in blood diseases, gonorrhœa and leprosy. A kind of

Tinduka called Visha-tinduka, "poisonous tinduka," is said to have similar properties; as well as a plant called Kanki or Kinkini. Mir Muhammad Husain, speaking of Ebony, mentions *Gàb* as a kind of Indian ebony, but is silent as to its medicinal uses. Rheede (*Hort. Mal iii.*, p. 46), speaking of *D. Embryopteris*, says—"Arboris cortex in pulverem redactus ac cum oryzæ infuso, et expresso e matura nuce Indica lacteo succo mixtus, atque febricitantibus exhibitus æstum potenter extinquit; ex seminibus oleum exprimitur." The circumstance that the unripe fruit abounds in an astringent viscid juice, which is used by the natives of India for daubing the bottoms of boats, was communicated by Sir William Jones to Roxburgh in 1791. The introduction of the fruit into European medical practice in India is due to O'Shaughnessy. In 1868 it was made official in the *Pharmacopœia of India.* The fruit is eaten by the poorer classes. The seeds are preserved by the country people and given as an astringent in diarrhœa. The testa is the astringent part, the albumen being almost tasteless. Although the ripe fruit is very sweet, insects will not touch it.

Description.—Fruit subglobose, 1 to 2 inches in diameter, sometimes larger; glandular or rusty, yellow when ripe, and covered with a rust-coloured farina consisting of clubbed hairs. Seeds 8 in the perfect fruit, often less by abortion, arranged vertically round the central core, reniform, immersed in glutinous pulp. Fruiting calyx much accrescent, lobes ¼ inch, ovate, auriculate, base cordate, nearly glabrous.

Diospyros fruit is very astringent until quite ripe, when it becomes mawkish and sweet. This is noticed in the *Pharmacographia*, but not in the *Indian Pharmacopœia*, where unripe fruit should have been ordered.

Chemical composition.—The tannic acid of these fruits has the following reactions. A blue-black colour with ferric chloride; violet-black colour and precipitate with ferrous sulphate; pinkish precipitate with gelatine; curdy precipitate with iodine in potassium iodide; orange sediment with bromine water; brown precipitate with cupric acetate; yellowish brown precipitate with potassium dichromate; aqueous alkalies afforded precipitates which changed in colour and became soluble by oxidation; grey precipitate with limewater, turning red by exposure to the air; it reduced the copper when boiled with Fehling's solution. The lead compound of the tannic acid contained 48·78 per cent. of oxide, whether prepared from the aqueous or alcoholic extract of the fruit. Boiled for two hours with dilute hydrochloric acid, the astringent principle was decomposed with the formation of two colouring matters and a body answering to glucose. The inspissated juice was not redissolved entirely even in boiling water, about thirty per cent. of pure soluble tannin was obtained from it, the remainder was an insoluble gum swelling up like tragacanth. The amount of astringent acid obtainable from the fruits examined by us was 12·8 per cent., and we consider it to be closely related to gallotannic acid.

Several species of Diospyros have fruit with the astringent properties of *D. Embryopteris* when unripe. The root of **D. Tupru** is used by the Marathás to make the Akshata mark (the sectarial circlet on the forehead), under the name of Akshaté ché khor, "akshata wood." The leaves are an article of commerce, being largely used for folding *viri*, "native cigarettes." The fruits contain 5·7 per cent. of tannic acid.

D. Ebenum affords Ebony, the 'Abnus' of the Mahometan Materia Medica. It is described as astringent, attenuant, and lithontriptic, and was used by the ancients. (*Cf. Dios. i.*, 114; *Pliny* 12, 8.)

The fruits of **D. montana** contain a very interesting colouring matter, which seems to be the chief ingredient besides sugar and malic acid but no tannic acic. The colouring matter is soluble in spirit and partly so in water. It is insoluble in ether, and gives an intense purple with alkalies. Subjected to hydrolosis it breaks up into a body soluble in ether, also pigmental, and a sugar. The fruits are used by the hill-men of Travancore for poisoning fish.

D. Kaki, a tree of China and Japan, cultivated in some parts of India, has an edible fruit which is known as the Chinese Persimmon. The fruit is green, globular, from two to three inches in diameter, and when ripe has an agreeable sweetness and flavour. The dried and powdered fruit contained 54·2 per cent. of sugar reducing Fehling's solution, an organic acid, no tannin, and a colouring matter soluble in ether similar to that of the fruits of *D. montana*.

The following shows the proximate analyses of the dried and powdered fruits freed from the seeds of four species of Diospyros:—

	Embryopteris.	Tupru.	montana.	Kaki.
Ether extract...............	1·2	2·1	10·0	1·5
Spirit extract	12·4	6·3	6·8	66·1
Water extract	7·5	4·4	6·3	11·5
Albuminous matter, &c...	12·1	16·4	12·5	3·0
Organic residue...........	61·9	65·1	58·6	14·1
Ash.........................	4·9	5·7	5·8	3·8
	100·0	100·0	100·0	100·0

STYRACEÆ.

STYRAX BENZOIN, *Dryander*.

Fig.—*Bentl. and Trim.*, *t.* 169. Gum Benjamin tree (*Eng.*), Aliboufier de Benjoin (*Fr.*).

Hab.—Sumatra, Java, Siam. Gum Benzoin.

Vernacular.—Lubán, Ud (*Ind. Bazars*).

History, Uses, &c.—Benzoin or Gum Benjamin does not appear to have been known to the ancient Hindus, nor is there any evidence that the Greeks and Romans, or even the earlier Arabian physicians, were acquainted with it There is however no doubt that in the original and legitimate Storax they were acquainted with a fragrant resin in separate or more or less agglutinated tears, somewhat resembling Benzoin, and produced by the *Styrax officinalis* of Linnæus. Specimens of this amygdaloid storax are still to be found in old Materia Medica collections. (*Hanbury's Science Papers,* p. 129.) Benzoin is first mentioned by the Arabian traveller Ibn Batuta, who visited Sumatra between A. D. 1325 and 1349. He calls it Lubán Jáví or Java Lubán, Java being a general name among the Arabs and Persians for the Eastern Archipelago. It is not mentioned by the Persian druggist Háji Zein, A. D. 1368. In more recent Arabic and Persian works, Benzoin is called Hasi-lubán-el-Javi, which may be translated 'pebbly or amygdaloid frankincense from Java,' and seems to imply the existence of another kind of pebbly frankincense. The author of the *Makhzan-el-Adiwya* states that Hasi-lubán-el-Javi is the same as Darv or Zarv (ضرو). On turning to this article, we find the following synonyms given: Fúzúkas* (*Greek*), Zarwa (*Syrian*), Fashashísh (*Turkish*), Dur-i-haskhak Arísa, Kalangúra, and Kamkám (*Persian*). This tree is said to grow in the Hejaz, Yaman, India and other countries, and to resemble the oak, the leaves being soft and reddish at the edges, and the fruit a cone like the fir, but with larger seeds; its bracts and spines turn red when ripe. The exudation is at first like a grain of wheat, but gradually increases until it reaches the size of a melon; from it a dark pitch-like substance may be separated. A decoction of the leaves is mentioned, and an oil which is obtained from the seeds. This description might do for *Liquidambar orientale,* but cannot apply to *Styrax Benzoin.* As regards the drug benzoin, Mír Muhammad Husain must have been well acquainted with it, as it was in common use in India before his time. He probably regarded it as a kind of amygdaloid storax. Ainslie mentions its use in Southern India by Tamool physicians as a remedy in phthisis and asthma.

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* Probably a corruption of ζυγὸς, a name applied to the Storax tree by the modern Greeks.

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The Mahometans use it for the same purpose, and direct the fumes to be inhaled. As an incense it is much used by all classes, the imports into Bombay alone averaging 6,000 cwts. per annum. For the early history of this drug in Europe, the *Pharmacographia* may be consulted. In that work will also be found a summary of what is known regarding the method of collecting it in Sumatra and Siam.

Description.—The following excellent description, together with a summary of its chemical composition, is extracted from the *Pharmacographia* :—

"SIAM BENZOIN.—The most esteemed sort is that which consists entirely of flattened tears or drops, an inch or two long, of an opaque, milk-like white resin, loosely agglutinated into a mass. More frequently the mass is quite compact, consisting of a certain proportion of white tears of the size of an almond downwards, imbedded in a deep, rich amber-brown, translucent resin. Occasionally the translucent resin preponderates, and the white tears are almost wanting. In some packages the tears of white resin are very small, and the whole mass has the aspect of a reddish-brown granite. There is always a certain admixture of wood, bark and other accidental impurities.

"The white tears, when broken, display a stratified structure with layers of greater or less translucency. By keeping, the white milky resin becomes brown and transparent on the surface, but from some experiments made by one of us (F.) it does not appear that opacity is due to water, but rather to a peculiar molecular (semi-crystalline ?) state of the resin. Siam benzoin is very brittle, the opaque tears showing a slightly waxy, the transparent a glassy, fracture. It easily softens in the mouth, and may be kneaded with the teeth like mastich. It has a delicate balsamic, vanilla-like fragrance, but very little taste. When heated it evolves a more powerful fragrance together with the irritating fumes of benzoic acid; its fusing point is 75° C. The presence of benzoic acid may be shown by

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the microscopical examination of splinters of the resin under oil of turpentine.

"Siam benzoin is imported in cubic blocks, which take their form from the wooden cases in which they are packed while the resin is still soft."

"SUMATRA BENZOIN.—Prior to the renewal of direct commercial intercourse with Siam in 1853, this was the sort of benzoin most commonly found in commerce.

"It is imported in cubic blocks exactly like the preceding, from which it differs in its general greyer tint. The mass, however, when the drug is of good quality, contains numerous opaque tears, set in a translucent, greyish-brown resin, mixed with bits of wood and bark. When less good, the white tears are wanting, and the proportion of impurities is greater. We have even seen samples consisting almost wholly of bark. In odour, Sumatra benzoin is both weaker and less agreeable than the Siam drug, and generally falls short of it in purity and handsome appearance, and hence commands a much lower price. The greyish brown portion melts at 95°, the tears at 85° C."

Chemical composition.—Benzoin consists mainly of amorphous resins perfectly soluble in alcohol and in potash, having slightly acid properties, and differing in their behaviour to solvents. If two parts of the drug are boiled with one part of caustic lime and twenty parts of water, benzoic acid is removed. From the residue the excess of lime is dissolved by hydrochloric acid, and the remaining resins washed and dried. About one-third of them will be found readily soluble in ether, the prevailing portion dissolves in alcohol, and a small amount remains undissolved. Subjected to dry distillation, benzoin affords as chief product *Benzoic acid*, $C^7H^6O^2$, together with empyreumatic products. Benzoic acid exists ready formed in the drug to the extent of from 14 to 18 per cent., its extraction is easily accomplished by the aid of an alkali, most advantageously by milk of lime, which does not combine with the amorphous resins. Most pharmacopœias require not the inodorous acid obtained by a wet process, but that afforded by sublimation, which contains a small amount of fragrant empyreumatic products. The resin when repeatedly subjected to sublimation affords as much as 14 per cent. of benzoic acid.

Kolbe and Lautemann in 1860 discovered in Siam and Pennang benzoin together with benzoic acid, an acid of different constitution, which in 1861 they recognised as *Cinnamic Acid*, $C^9H^9O^2$. Aschoff (1861) found in a sample of Sumatra benzoin, cinnamic acid only, of which he got 11 per cent.; and in amygdaloid Siam and Penang benzoin only benzoic acid. In some samples of the latter, one of us (F.) has likewise met with cinnamic acid. (*Op cit.*, 2nd Ed., p. 407.)

Commerce.—The imports of Benzoin into Bombay in the year 1871-72 were 5,975 cwts., and the exports 1,043 cwts.; no later statistics are available, but there is probably little difference in the quantity imported. Average value in Bombay, first quality, Rs. 30 to Rs. 35 per maund of 37½ lbs. An artificial benzoin is manufactured in the bazar, in which pieces of silicate of magnesia are embedded in common American resin. It is largely retailed to the poor, who purchase small quantities for religious uses.

SYMPLOCOS RACEMOSA, *Roxb.*

Hab.—North-East India, Burma. The bark.

Vernacular—Lodh, Tilak (*Hind.*), Lodh (*Beng.*), Lodhra (*Mar.*), Lodhar (*Guz.*), Jáláriyaméd (*Can.*).

History, Uses, &c.—This tree, in Sanskrit Lodhra or Rodhra, Srimata, "propitious," and Tilaka, "because it is used in making the Tilaka mark on the forehead," is described in the Nighantas as hot, alterative, and useful in phlegmatic diseases and leprosy. In the Bhávaprakása it is said to be absorbent, stomachic, refrigerent, astringent, expectorant and hæmostatic, and to be useful in eye diseases, liver, fevers, dysentery and dropsy. A decoction of the bark is used as a gargle when the gums are spongy and bleeding. (*Susruta.*) It enters into the composition of various pastes which are applied

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to inflamed parts; it is supposed to promote the maturation and resolution of stagnant humours. In fevers, dysentery and liver complaints, compound decoctions and infusions are used, and in dysentery a compound powder containing liquorice root, *Myrica sapida* bark, and pomegranate rind in equal proportions to the Lodhra bark. (*Sarangadhara, Chakradatta.*)

Roxburgh remarks that the bark is in request among the dyers of red in Calcutta, and seems to be used as a mordant only. He gives the following receipt:—"For three yards of cloth take Lodh bark, Chebulic myrobalans of each 2 ozs., rub them down with water, then add more water, steep the cloth and dry it. Next take 2 ozs. of alum, dissolve it in water and boil the cloth in the solution for an hour, then wash and dry it. Lastly, take the bark of *Morinda tinctoria* and flowers of *Woodfordia floribunda* of each 2 ozs., Madder root 1 lb., mix them with lukewarm water and let it boil, then put in the cloth and keep it in the boiling liquid for forty minutes." In this receipt the Lodh appears to be used as a dye to modify the colour afterwards produced by the Morinda and Madder. The middle layers of Lodh bark contain much red colouring matter.

In Europe it was formerly looked upon as a cinchona bark, and has been known at various times as "*Ecorce de lautour,*" "*China nova,*" "*China Calafornica,*" "*China Brasilensis,*" and "*China Paraquatan.*" It is now known as "Lotur bark." Drs. Charles and Kanny Loll Dey recommend the bark in 20 gr. doses mixed with sugar as a remedial agent in menorrhagia due to relaxation of the uterine tissue; it should be given two to three times a day for three or four days. Dr. K. L. Dey considers that the drug has a specific action upon relaxed mucous membranes. (*Phar. Journ, Sept.* 24, 1881.)

Description.—The bark is very soft and friable, of a light fawn colour; the external surface corky and much fissured transversely; the internal of a lighter colour and fibrous texture. On making a transverse section a middle layer of a red colour is seen between the corky and fibrous portions.

Microscopic examination shows that the coloured layer is chiefly composed of oblong cells containing red colouring matter; the inner layer of the bark consists almost entirely of woody fibre. The taste is faintly balsamic and astringent.

Chemical composition.—Dr. Hesse reports (*Ber. d. deutsch ch. Geselsch*, X., 1,) that he has obtained from this bark three alkaloids, which he has named "*Loturine*," "*Colloturine*," and "*Loturidine*," and between which he thinks probably there is the same relation as exists between cusconine, aricine, and cusconidine. Loturine is present in largest quantity (0·24 per cent.); it is crystalline, and forms crystalline salts. Colloturine is also crystalline but loturidine is amorphous. All three alkaloids in dilute acid solutions show an intense blue-violet fluorescence. Winckler obtained from this bark an alkaloidal substance which he named "*Californine*," but Hesse believes this to have been a mixture of the acetates of the three alkaloids. Pelletier, Caventou and Winckler have separated *Kinovin* (Quinovin) from the bark of *China nova.* Kinovin forms an amorphous, nearly transparent resin, triturable to a light, white powder, inodorous, or faintly balsamic when warmed. Tasteless at first, but afterwards very persistently and disagreeably bitter and acrid; neutral; electric when rubbed. (*Winckler, Hlasiwetz.*) In alcoholic solution it exerts a dextro-rotatory action on polarised light; $(\alpha)\ j = 52{\cdot}4$ (De Vrij). Kinovin may be obtained in the anhydrous state by keeping it in a vacuum for a month, but cannot be dehydrated at once, even at a temperature of 190°: kinovin dried at 100° to 140° contains from 1 to 2 atoms of water, which is given off at 160° to 180°. (*Hlasiwetz.*) According to Hlasiwetz, kinovin corresponds with the formula $C^{60}H^{48}O^{16}$; according to Petersen the formula is $C^{15}H^{12}O^{4}$; according to Schnederman $C^{38}H^{30}O^{10}$. (*Gmelin, Handbook* xviii., p. 26.) The bark contains no tannin according to Hummel. The ash amounts to 7·4 per cent. containing 18 per cent. of carbonate of soda.

Commerce.—The bark is obtainable in all the Indian markets. Value, Rs. 3 to 3½ per Surat maund of 37½ lbs.

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OLEACEÆ.

NYCTANTHES ARBOR-TRISTIS, *Linn.*

Fig.—*Bot. Reg.*, *t.* 399; *Bedd. Fl. Syl.*, *t.* 240; *Gärtn. Fruct.* ii., *t.* 138. Weeping Nyctanthes, Night Jasmine (*Eng.*), Nictanthe Arbre-triste (*Fr.*), Arvore da notte (*Port.*).

Hab.—Central India. Cultivated throughout India. The leaves, fruit and bark.

Vernacular.—Harsinghár, Hár, Siháru (*Hind.*), Sephalika (*Beng.*), Pártaka, Khurasli (*Mar.*), Manja-pu (*Tam.*), Harsing (*Can.*), Poghada (*Tel.*), Pakúra (*Punj.*).

History, Uses, &c.—Royle in his Himalayan Botany states that this tree is extremely common along the foot of the mountains which skirt the Dehra Dhoon, and may be seen for several hundred feet above Rajpore in the ascent to Mussoorie. Dr. Wallich found it in a wild state near the banks of the Irrawaddy, on the hills near Prome. In all parts of India it is one of the commonest cultivated shrubs, its flowers open at sunset, and fall before morning; they have a very strong perfume. The Sanskrit names for the tree are Sephálika; Párijátaka; Rajanihása, "night-smiling"; and Atyúhá, "very pensive." According to the Indian legend, a certain Nága (prince) called Párijáta had a daughter of whom the Sun became enamoured, but he soon deserted her for another sweetheart; whereupon the damsel pined away and died of grief. Upon the spot where she died sprang up the tree Párijataka, whose flowers have such a dread of the Sun that they fall from the tree in the early morning before he rises.

Chakradatta mentions the use of the leaves in fever and rheumatism; a decoction of the leaves prepared over a gentle fire is recommended by several writers as a specific for obstinate sciatica. In the Concan about 5 grains of the bark are eaten with Betel-nut and leaf to promote the expectoration of thick phlegm.

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The author of the *Makhzan* gives a minute description of all parts of the tree, and states that the Indians use the white portion of the flowers as a purple dye, which they call Gulkámah, and the orange part as a yellow dye. The seeds and leaves are considered by them to have medicinal properties. Six or seven of the young leaves are rubbed up with water and a little fresh ginger, and administered in obstinate fevers of the intermittent type, at the same time a purely vegetable diet is enforced. The powdered seeds are used to cure scurfy affections of the scalp. Directions for the preparations of Gulkámah will be found in the *Karabádin-i-kabir*.*

Description.—Tree, 15 to 20 feet, young shoots 4-sided, leaves opposite, short-petioled, cordate or oblong, pointed, entire, or coarsely serrate, scabrous; panicles terminal, composed of small six-flowered terminal umbellets, calyx campanulate, slightly 5-notched, downy; corolla tube cylindric, as long as the calyx, segments 5 to 7; involucel of four inverse-cordate, opposite, sessile leaflets; flowers numerous, tube orange-coloured, border white, fragrant. The fruit is a dry, flat, oblong, mucronate capsule, prominently veined, ¾ inch long by ½ inch broad; it is of a brown colour when ripe, and is divided into two cells, each of which contains a flat foliaceous seed of a light brown colour; the testa of the seed is thin, the kernel white, bitter and very astringent. The leaves have similar properties, and stain the saliva when chewed.

Chemical composition.—The fresh leaves were digested with 80 per cent. alcohol, and most of the alcohol recovered by distillation. The concentrated tincture deposited a large amount of resin and colouring matter on spontaneous evaporation. When the liquid had ceased to smell of alcohol, it was acidulated with dilute sulphuric acid, which caused the precipitation of a dark resin. After filtration the clear filtrate was neutralized with ammonia and agitated with ether. The ethereal solution was evaporated to dryness, mixed with dilute sulphuric acid and again agitated with ether: finally the aqueous acid solution was again neutralized and agitated with ether. Operating in this manner, an alkaloidal principle was isolated, which we provisionally call *Nyctanthine*. Nyctanthine gives a marked precipitate with alkaloidal reagents, but no special colour reactions. In addition to an alkaloid, the presence of a trace of an oily principle was detected, which had a taste somewhat similar to that of oil of peppermint. An astringent principle, giving a greenish coloration with ferric chloride, with resins, and a sugar readily reducing an alkaline copper solution on boiling, were also present.

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* A well-known Persian Pharmacopœia.

Jasminum grandiflorum, *Linn.*, Spanish Jasmine or *Chambeli*, is cultivated almost everywhere in India. The Sanskrit name is Játi; from the flowers a perfumed oil is prepared which is a favourite perfume amongst the Hindus. Their physicians prescribe the leaves as a remedy in skin diseases, ulcers of the mouth, otorrhœa, &c. Chakradatta mentions the use of the fresh juice of the leaves as an application to soft corns, and of an oil prepared with it in otorrhœa. In the Bhavaprakása the leaves are recommended to be chewed by those who suffer from ulceration of the mucous membrane of the mouth.

Mahometan writers consider the plant to have deobstruent, anthelmintic, diuretic and emmenagogue properties. Mír Muhammad Husain mentions the use of the flowers applied in the form of plaster to the loins and pubes as an aphrodisiac. He classes *J. grandiflorum* along with several other kinds of Jasmine under the name of Yasmín.

Chemical composition.—The air-dried leaves were exhausted with 80 per cent. alcohol, and the alcoholic extract mixed with water and agitated with benzole. The benzole extract contained much colouring matter and some resin. During agitation with benzole, a soft black resin separated. This resin was easily soluble in alkalies and reprecipitated by acids. The clear aqueous fluid after agitation with benzole was acidulated with dilute sulphuric acid, which caused a turbidity. After filtration, the liquid was agitated with ether, the extract contained astringent matter, and salicylic acid. The aqueous

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solution was then rendered alkaline and reagitated with ether, the ethereal extract contained an alkaloid, for which we propose the name *Jasminine*, and which afforded no special colour reactions.

The *Mogra*, **J. Sambac**, is considered to have the the same properties as *J. grandiflorum*. In the *Pharmacopœia of India* the flowers, upon the authority of Mr. J. Wood, are said to have considerable power as a lactifuge; he speaks of them as effectual in arresting the secretion of milk in the puerperal state, in cases of threatened abscess. For this purpose about two or three handfuls of the flowers are bruised and applied to the breasts and renewed once or twice a day. The secretion is sometimes arrested in twenty-four hours, though generally a longer time is required. Mr. Wood speaks of this practice as being well known in Madras.

The wild single variety, called *Vikhmogra* or *Vishmogra*, (*Rheede vi.*, 56,) is used as an emmenagogue.

The juice of the leaves of **J. arborescens**, *Roxb.*, is used with pepper, garlic and other stimulants as an emetic in obstruction of the bronchial tubes by viscid phlegm. Seven leaves will furnish sufficient juice for a dose. For young children the juice of half a leaf and of four leaves of Agásta (*Sesbania grandiflora*) may be mixed with two grains of black pepper and two grains of dried borax and given in honey.

The bark and leaves of the following plants, belonging to this Order, are used by the hill villagers in the Madura District, in the preparation of Sago-toddy.

They are believed to assist and regulate the process of fermentation, but do not directly impart any intoxicating properties to the liquor.

Olea glandulifera, *Wall. Wight. Ic., t.* 1238; *Bedd. Fl. Sylv. t.* 238. Kadaly (*Tam.*).

The bark, which is externally greyish with whitish specks, internally brown and about $\frac{1}{8}$ of an inch in thickness, breaking with a close granular facture, contains a bitter glucoside and quercetin. The water-extract amounts to 14·5, spirit extract 12·9, and ash 8·2 per cent.

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Jasminum flexile, *Vahl., Wight Ic. t.* 1253; *Burm. Zeyl. t.* 58, *f.* 1. Mullu-gundu (*Tam.*).

A woody climber, stems about one inch in diameter, very woody and knotted, covered with a light yellowish brown, papery bark, exfoliating on the surface, contains a bitter glucoside and colouring matter. The water extract amounts to 9·6, spirit extract 6·6, and ash 7·9 per cent.

Ligustrum Roxburghii, *Clarke, Wight Ic.* 1242. Pungala (*Tam.*).

The bark is of a russet brown colour, and ¼ of an inch thick; fracture close, showing thick white fibres running through the brown inner and middle layers. The leaves are ovate or ovate lanceolate; dark green, smooth, entire, lighter on the under surface. Its chemical composition is similar to that of *J. flexile.*

SALVADORACEÆ.

SALVADORA PERSICA, *Garcin.*

Fig.—*Roxb. Cor. Pl. i., t.* 26; *Bedd. Fl. Sylv., t.* 247; *Wight Ill. ii., t.* 181.

SALVADORA OLEOIDES, *Dcne.*

Fig.—*Jacq. Voy. Bot., t.* 144; *Brand. For. Fl., t.* 39; *Wight Ic., t.* 1621.

Hab.—The drier parts of India. The leaves, fruit, bark and oil.

Vernacular.—Pilu, Jhál (*Hind.*), Pilu (*Beng., Guz.*), Kakhan (*Mar.*), Kalarva, Kárkol, Ughai-puttai (*Tam.*), Varagogu (*Tel.*).

History, Uses, &c.—The two species of Salvadora grow upon the sea coast of Arabia, Persia and Western India, as well as in the arid districts of the interior. They are the Pilu of Sanskrit writers, and in the Nighantas bear the synonyms of Sahasrá, Karambha-priya, Tatphala, etc. The

Hindus consider the fruit to be hot, digestive, lithontriptic, fattening and light; and to be beneficial in enlarged spleen, rheumatism, tumours and lithiasis; it is also thought to have alchemic or alterative properties. In Marwar and other parts of Northern India the berries of *S. oleoides* and *S. persica* are largely collected and dried in the sun as an article of diet. When dry they resemble grape currants both in appearance and taste. From the seeds an oil is expressed, which is used as a stimulating application in painful rheumatic affections and after childbirth. The leaves of these trees heated and tied up in a cloth with those of *Vitex trifolia* are a favorite domestic remedy for rheumatic pains.

The Arabs call the Salvadoras Arák and the Persians Darakht-i-miswák, "tooth-brush tree," short pieces of the root, about the size of goosequill, being used to clean the teeth. On the coast of Persia bordering the Persian Gulf these shrubs are called Chúch, and are depastured by camels and buffaloes. They are said to render the milk very rich and thick. This property of the plant as a fodder is also known in India. The author of the *Makhzan-el-Adwiya* describes the fruit as deobstruent, carminative and diuretic, and remarks that a poultice of the leaves, which have similar properties, is used to relieve the pain caused by tumours, piles, etc.

Forskahl (*Ægypt–Arab.*, p. 32) has the following notice of Salvadora:—"In magno est pretio; fructus (*Kabath*) maturus edulis; folia contusa imponuntur tumoribus naram (ورم) dictis et bubonibus; sed vis antitoxica adeo famosa, ut carmine quoque celebretur." Kabáth is the Arabic name for the ripe fruit, when unripe it is called بریر (barir).

Ainslie gives *Ooghai-puttai* as the Tamil name of *S. persica*, and says, "the bark, which is a little warm and somewhat acrid, is recommended by the Hindu doctors, in decoction, in cases of low fever, and as a tonic and stimulant in amenorrhœa. The bark of the root when fresh acts as a vesicatory." (*Mat. Ind.* ii., p. 266). In the *Pharmacopœia of India*, we are told that Dr. Irvine employed the root-bark successfully as a vesicant. In Dr. Imlach's Report on Snake-bites in Sind (*Bomb. Med. and. Phys. Trans. New Ser.*, iii., p. 80,) several cases are mentioned in the tabular record, in which Pilu seeds were administered internally, with good effect. They are also said to be a favorite purgative.

Royle considers *S. persica* to be the mustard tree of the New Testament, and says that the Syrian Arabs call it Khardal, *i. e.* "mustard."

Description.—*S. persica* and *S. oleoides* are small trees or shrubs with a crooked trunk, seldom more than one foot in diameter; bark scabrous and cracked, whitish; branches numerous, spreading; their extremities pendulous, like those of the weeping willow; leaves opposite, petioled, oval or oblong, veinless, shining on both sides, fleshy, from 1 to 2 inches long, and one inch broad; flowers minute, greenish yellow, in terminal panicles from the exterior axils; berry in *S. persica* small, smooth, red, juicy; in *S. oleoides* it is larger and yellow. The solitary seeds have a strong aromatic smell, and taste like garden cress. The oil of *S. oleoides* is of the consistence of butter, of a bright green colour, and pungent odour. That sold in the shops is usually adulterated, and is of a greenish yellow colour, and of greater consistency than the genuine article.

The root-bark when fresh is of a light brown colour and nearly smooth, studded pretty thickly with scabrous corky warts, either single or arranged in transversely extended patches. The substance and inner surface of the bark is white and soft; fracture short; odour like cress; taste warm and pungent.

Microscopic structure.—The epidermis is formed of several rows of brick-shaped cells containing brown and green colouring matter; within this the cells of the parenchyma are brick-shaped and arranged in rows for some distance inward, afterwards the arrangement becomes more irregular, and the cells are loaded with starch, a few oil globules, and raphides; towards the inner part of the bark are a few large yellow stone cells. The wood is porous; the vascular system composed of large, very

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fine dotted vessels. The medullary rays are remarkable for the number of large raphides contained in their cells.

Chemical composition.—The air-dried root bark of *S. Persica* was reduced to powder and extracted with 80 per cent. alcohol, the greater part of the alcohol recovered by distillation, and the last traces removed by spontaneous evaporation. The resulting extract was mixed with water, acidulated with sulphuric acid and agitated with ether. The ether extract contained some resin and colouring matter. During agitation with ether, brown flocks separated, which were subsequently collected by filtration. These flocks were partly soluble in alkalies, the alkaline solution giving a precipitate on the addition of acids: the alcoholic solution was neutral, and gave no reaction with ferric salts.

The original acid aqueous solution was rendered alkaline and reagitated with ether, and the ether driven off by a current of cold air. During evaporation there was a marked odour of *trimethylamine*. The ethereal extract consisted of a soft yellow resin-like substance, and a small amount of clear watery fluid. The reaction was strongly alkaline; a few drops applied to the skin caused a painless redness in about 10 minutes; no vesication ensued. A glass plate was moistened with dilute sulphuric acid and placed over the capsule containing the extract. After some time an odourless, crystalline deposit was observed, which, on the addition of an alkali, afforded the odour of trimethylamine. The remainder of the ethereal extract was heated for some hours in the water bath to 100° C. The residue was partly soluble in acids, and afforded all the reactions of an alkaloid. This residue was without any action when applied locally to the skin. After agitation with ether, the still alkaline original liquid was agitated with chloroform, which separated a further quantity of trimethylamine, and traces of an alkaloid. We propose calling the alkaloid *Salvadorine*.

The air-dried root-bark lost 13·76 per cent. when heated to 100° C., the ash amounted to 27·06 per cent., and was

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remarkable for the large amount of chlorine present. No manganese was detected. The juice of the fresh bark and leaves had an acid reaction.

It appears to us highly probable that the stimulating effects of the fresh bark, when applied locally, are due to the presence of trimethylamine, a part of which no doubt exists in it in a free state, and the remainder as a salt, most likely as the chloride. The rapid and painless manner in which the dilute aqueous solution of trimethylamine produces redness of the skin, might perhaps be utilized, if the extremely offensive odour of the drug were not a bar. Trimethylamine is stated to act in a similar manner to aqueous ammonia locally, but it appears to us that trimethylamine is more active.

The fleshy portion of the dried fruit of *S. oleoides* has a taste similar to that of grape currants, and contains a large amount of sugar, which reduces an alkaline copper solution on boiling. The seeds contain a white fat with a melting point of 39 to 40° C (uncorr.). The alcoholic solution was neutral to litmus paper. We also isolated an alkaloid, soluble in ether and amylic alcohol, and giving very marked precipitates with alkaloidal reagents, but no special colour reactions. It also afforded marked precipitates with chromate and bichromate of potassium from its solution in H^2So^4. The taste was somewhat bitter and harsh. We are not in a position to state whether this principle differs or not from the one we detected in the root bark. A yellow colouring principle is also present in the seeds, which gives a deep bright yellow coloration with alkalies.

AZIMA TETRACANTHA, *Lam.*

Fig.—*Wight Ill. ii., t.* 152; *Gärtn. Fruct. t.* 225.

Hab.—Deccan Peninsula and Ceylon. The leaves, root, and juice.

Vernacular.—Kanta-gúrkamai (*Hind.*), Trikant a-jati (*Beng.*), Sukkapát (*Mar.*), Sungam-cheddi (*Tam.*), Tella-upi (*Tel.*).

History, Uses, &c.—The leaves, root, and milky juice are bitter, and are used medicinally by the Hindus. Dr. P. S. Mootooswamy (*Ind. Med. Gazette*, October, 1889,) states that the leaves are considered stimulant, and are given to puerperal women immediately after confinement. They are administered in the following manner by the villagers:—The leaves with an equal quantity of Neem leaves, and a little powdered brick, are finely ground and given twice a day for the first two days, no food being allowed. For the next six days the woman gets a little boiled rice and pepper water once a day, and is allowed to drink a little warm water after the meal; she is not allowed to sleep after her food during the day, and if thirsty must quench her thirst by eating betel leaves and areca nut. From the seventh day she gets her ordinary food. It is also the practise among the rural classes to give 2 to 4 ounces of Neem oil soon after delivery, with a little roasted asafœtida, and the woman is made to take daily for a month from the morning of the third or fourth day a bolus of a stimulating confection, called *Naday-cayam* in Tamil, which is supposed to keep off cold from the system. (This practice is general amongst the country people in most parts of India.)

The leaves are also administered with food as a remedy for rheumatism, and their juice to relieve cough.

The root is considered to have the same properties as the leaves, and to be also diuretic; it is given in dropsy along with other drugs. Dr. Mootooswamy gives the following formula as much used by native doctors:—Take of the root bark ℥x, *Tribulus terrestris* fruit, root of *Trianthema monogyna* and *Cephalandra indica* ā ʒi, Beleric and chebulic myrobalans ā ʒss, Iron dross ℥x, Goat's urine ℥viii, Water four sers. Make a decoction and keep it for several days in the oven. Dose 2 to 3 ounces twice a day in as much water.

A decoction of the root, leaves and bark with an equal quantity of *Acorus Calamus*, ginger, ajowan seeds and salt is recommended as a remedy for chronic diarrhœa, and 1 to 1½ ounces of the juice obtained from the root bark, with

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three ounces of goat's milk, twice a day as a diuretic in dropsy.

Description.—Stem scarcely any, but branches innumerable, opposite, spreading in all directions, forming a close impenetrable bush, something like the Furze; young branches four-sided. Thorns axillary, four-fold, spreading, very sharp, from 1 to 2 inches long. Leaves opposite, short-petioled, reflexed, oval, acute. Male flowers axillary, numerous, female axillary, solitary, sessile, between the two thorns. Berry globular, of the size of a pea, when ripe white, succulent, edible. Seeds two. The plant is in flower and fruit the greater part of the year.

APOCYNACEÆ.

ALSTONIA SCHOLARIS, *Br.*

Fig.—*Wight Ic.*, *t.* 422; *Bedd. For.*, *Fl.*, *t.* 242; *Rheede Hort. Mal. i.*, *t.* 45; *Bentl. and Trim. t.* 173.

Hab.—Drier forests of India. The bark and leaves.

Vernacular.—Chhatián, Dátyúni (*Hind.*), Chhátin (*Beng.*), Sátvin (*Mar.*), Ezhilaip-pálai (*Tam.*), Edakula-pala, Pala-garuda (*Tel.*), Janthalla (*Can.*).

History, Uses, &c.—The tree is called in Sanskrit Saptaparna, Sapta-chhada, Guchha-pushpa, Vrihat-tvak and Vishala-tvak, "having large or thick bark." Hindu physicians describe it as tonic, alterative, and useful in fever, skin diseases, and dyspepsia. Susruta gives the following formula for use in catarrhal dyspepsia:—"Take of the bark of *Alstonia*, stems of *Tinospora cordifolia*, bark of *Azadirachta indica*, and the bark of *Betula Bhojpatra*, equal parts, in all two tolas (320 grains), and prepare a decoction in the usual way." It also enters into the composition of several prescriptions for boils and other diseases of the skin. The specific name *scholaris* has been given to this tree from the fact of its planks, covered

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with a layer of sand, being used as school-boards on which children trace their letters as in the Lancastrian system. The natives of Western India have a superstitious fear of it, and say that it assembles all the trees of the forest once a year to pay homage. (*Graham.*)

Rheede in 1678 and Rumphius in 1741 described and figured the tree and noticed the medicinal use of the bark by the natives along with salt and pepper in febrile dyspepsia, and as a local application to ulcers and rheumatic joints. Rumphius's experience is, that the bark is useful in catarrhal dyspepsia and in the febrile state consequent upon that affection, and also for enlarged spleen. He says: "Of its value in catarrhal dyspepsia I can speak from experience; the dose should be 15 grains taken at bedtime in powder or decoction." Nimmo in 1839 called attention to the bark as a powerful tonic, and suggested its use as an antiperiodic. Dr. Gibson in 1853 contributed a short, but interesting, account of the drug to the *Pharmaceutical Journal* (xii., p. 422). Alstonia bark is official in the *Pharmacopœia of India*, and is described as an astringent tonic, anthelmintic, and antiperiodic. In the Concan the juice of the fresh bark with milk is administered in leprosy, and is also prescribed for dyspepsia and as an anthelmintic; and the juice of the leaves with that of fresh ginger root or zedoary is administered to women after confinement. One of us has found the tincture of the bark to act in certain cases as a very powerful galactagogue: in one case the use of the drug was purposely discontinued at intervals, and on each occasion the flow of milk was found to fail.

In 1874 Gruppe, an apothecary of Manilla, obtained from the bark a substance which he named *ditain*. In the report on the Centennial Exhibition presented to the American Pharmaceutical Association (Transactions 1877), the following account of this substance and of the use of the drug in Manilla is given:—"*Echites scholaris* (*Alstonia scholaris*, Brown,) grows wild abundantly in the central provinces of the island of Luzon, where it has long been known and esteemed by the natives under the name of 'Dita,' as a most efficient tonic and febri-

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fuge. The people having been in the habit of using it from time immemorial in decoction against malignant, intermittent, and remittent fevers with the happiest result, the attention of our leading physicians was excited, and the active principle ditain has now become a staple article, and ranks equal in therapeutical efficiency with the best imported sulphate of quinine. Numberless instances of private and hospital practice, carried out by our best physicians, have demonstrated this fact. Equal doses of ditain and of standard quinine sulphate have had the same medicinal effects; besides leaving none of the disagreeable secondary symptoms, such as deafness, sleeplessness, and feverish excitement, which are the usual concomitants of large quinine doses, ditain attains its effects swiftly, surely, and infallibly.

We use ditain generally internally in quantities of half a drachm daily for children, and double the dose for adults, due allowance being made, of course, for age, sex, temperament, &c. We derive very beneficial effects from its use, too, under the form of poultices. Powdered dita bark, cornflour, each half a pound; hot water sufficient to make a paste. Spread on linen and apply under the armpits, and on the wrists and ankles, taking care to renew when nearly dry, and provided the desired effects should not have been obtained. The results arrived at by ditain in our Manilla hospitals and private practice are simply marvellous. In our military hospital and penitentiary practice, ditain has perfectly superseded quinine, and it is now being employed with most satisfactory results in the Island of Mindanao, where malignant fevers are prevalent."

Description.—The drug consists of irregular fragments of bark, ⅛ to ½ an inch thick, easily breaking with a short coarse fracture. The external layer is very uneven and much fissured, dark grey or brownish, sometimes with black spots, it readily separates when handled. The interior substance and inner surface (liber) is of a bright buff. A transverse section shows the liber to be finely marked by numerous small medullary rays. The bark has no particular odour; when chewed it

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communicates gradually to the palate a slightly bitter but not disagreeable taste.

Microscopic structure.—The cortical tissue is covered with a thin suberous coat, the middle layer of the bark is built up of a thin-walled parenchyme, through which enormous, hard, thick-walled cells are scattered in great numbers, and are visible to the naked eye, as they form large irregular groups of a bright yellow colour. Towards the inner part these stone-cells disappear, the tissue being traversed by undulated medullary rays, loaded with very small starch grains; many of the other parenchymatous cells of the liber contain crystals of calcium oxalate. The longitudinal section of the liber exhibits large but not very numerous laticiferous vessels, as elongated simple cells with perforated tranverse walls (sieve-cells) containing a brownish mass, the concrete milk-juice with which all parts of the tree abound.

Chemical composition.—In 1875, Jobst and Hesse exhausted the powdered bark with petroleum ether, and then extracted, by boiling alcohol, the salt of an alkaloid, which they called *Ditamine.* After the evaporation of the alcohol, it is precipitated by carbonate of sodium and dissolved by ether, from which it is removed by shaking it with acetic acid. Ditamine as again isolated from the acetate forms an amorphous and somewhat crystalline, bitterish powder of decidedly alkaline character; the bark yields about 0·02 per cent.

From the substances extracted by means of petroleum ether, as above stated, Jobst and Hesse further isolated (1) Echicaoutchin, $C^{25}H^{40}O^2$, an amorphous yellow mass; (2) Echicerin, $C^{30}H^{48}O^2$, forming acicular crystals, melting at 157° C.; (3) Echitin, $C^{32}H^{52}O^2$, crystallized scales, melting at 170°; (4) Echitein, $C^{42}H^{70}O^2$, which forms rhombic prisms, melting at 195°; (5) Echiretin, $C^{35}H^{56}O^2$, an amorphous substance, melting at 52° C.

Echicaoutchin may be written thus: $(C^5H^8)^5O^2$, echicerin $(C^5H^8)^6O^2$, echiretin $(C^5H^8)^7O^2$; these formulæ at once indicate how nearly the three substances are allied. They are probably constituents of the milky juice of the tree. (*Pharmacographia, 2nd Ed., p.* 422.)

Hesse has since separated from Dita bark two other bases, *Echitamine* and *Echitenine.* He now reports that *Ditamine* exists in the bark in the proportion of 0·04 per cent. It is readily soluble in dilute acids, and differs from the alkaloids associated with it in being precipitated from its acid solution, by ammonia. Its formula deduced from the analysis of its platinochloride, is $C^{16}H^{19}NO^{2}$.

Echitamine is obtained from the liquor from which the ditamine has been extracted. On neutralizing this liquor, concentrating it by evaporation, and then adding hydrochloric acid and sodium chloride, impure echitamine hydrochloride is precipitated. The base isolated from this precipitate, and then purified, crystallizes in thick vitreous prisms, answering to the formula $C^{22}H^{28}N^{2}O^{4}+4H^{2}O$. When dried in vacuo these part with three molecules of water, leaving a strong base of the formula $C^{22}H^{28}N^{2}O^{4}+H^{2}O$, or $C^{22}H^{30}N^{2}O^{5}$, which the author calls echitamine hydrate, or echit-ammonium hydroxide. If in drying the heat be raised to and maintained at 150° C., another molecule of water is given off; but the anhydrous echitamine thus left is a much weaker base, and is reconverted into the original alkaloid by dissolving it in hydrochloric acid, and decomposing the hydrochloride. In consequence of the decided loss of basic properties accompanying the elimination of the last molecule of water, the author prefers to regard the monohydrated base as the normal form. The latter is a powerful alkaloid; it neutralizes acids perfectly, and yields well-defined crystallizable salts.

Echitenine.—This base is prepared from the mother liquors of echitamine hydrochloride, by precipitating with mercuric chloride, decomposing the precipitate with sulphuretted hydrogen, and then shaking with chloroform. It exists in the bark to the extent of only 0·01 per cent. Its composition corresponds to the formula $C^{20}H^{27}NO^{4}$. It is markedly bitter, of a brownish colour, and fuses above 120° C. With

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strong sulphuric acid it forms a reddish violet, and with nitric acid a purple solution, the latter of which changes to green and ultimately to yellow. Its salts are amorphous. In the author's opinion all these alkaloids belong to one series:—

Ditamine	$C^{16}H^{19}NO^{2}$
?	$C^{18}H^{23}NO^{3}$
Echitenine	$C^{20}H^{27}NO^{4}$
Echitamine Hydrate (Echit-ammonium Hydroxide)	$C^{22}H^{30}N^{2}O^{5}$

(*Liebig's Annalen, cciii.,* 144) *in Year-Book of Pharmacy for* 1881.)

Commerce.—The bark is not an article of commerce in India.

Rhazya stricta, *Decaisne. in Jacq. Voy. Bot., t.* 111.

Vernacular.—Sewar (*Sind*).

This plant is widely distributed through Western Asia, from Yemen in Arabia, to the North-West Provinces of India. Its leaves, which are very bitter, are sold in the bazars in Sind, the natives using them in the preparation of cooling bitter infusions. *R. stricta* is a stiff-growing plant with erect stems 2 to 3 feet high, and upright thickish smooth leaves placed rather close together on the stem. Dr. Stocks describes the infusion as a good and peculiar bitter tonic, and recommends it for trial.

HOLARRHENA ANTIDYSENTERICA, *Wall.*

Fig.—*Brand. For. Fl., t.* 40; *Wight Ic., t.* 1297; *Rheede Hort. Mal.* i., *t.* 47. Conessi or Tellicherry Bark (*Eng.*), Écorce de Codagapala (*Fr.*).

Hab.—Throughout the drier forests of India. The bark.

Vernacular Kura, Kaureya (*Hind.*), Kurchi (*Beng.*). Kuda, Pándhara-kuda (*Mar.*), Kuda, Doula-kuda (*Guz.*), Kulap-pálai (*Tam.*), Amkudu (*Tel.*), Kodamuraka, Kodasiga (*Can.*).

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The seeds: Karwa-indarjau (*Hind.*), Tita-indarjau (*Beng.*), Kulappalai-virai (*Tam.*), Amkudu-vittulu (*Tel.*), Kadu-indarjau (*Mar.*), Kadvo indarjau (*Guz.*); Kodu-murakan-bija (*Can.*).

History, Uses, &c.—The Sanskrit names for this useful tree are very numerous, the best known are Kutaja and Kalinga, amongst others we may mention Girimallika, Vatsaka "cow tree," Sakra sakhin "Indra's tree," and Sakrásana "Indra's food." The tree is fabled to have sprung from the drops of amrita which fell on the ground from the bodies of Rama's monkeys, which were restored to life by Indra. The seeds are called in Sanskrit Indrayava, Bhadrayava, Vatsakavija, or Sakravija, "Indra's seed." The bark is one of the most important articles in the Hindu Materia Medica, and is described in the Nighantás as bitter, astringent, cold and digestive; a remedy for piles, dysentery, bile, leprosy and phlegmatic humours. Susruta says it is expectorant, an antidote to poisons, cures dysuria, urinary and skin diseases, checks nausea and vomiting, removes pruritus, improves the condition of bad ulcers, relieves pains of the stomach, and checks the derangement of the three humours, *viz.*, phlegm, air and bile. The seeds are considered to be astringent, febrifuge and anthelmintic. Both bark and seeds are usually combined by Hindu physicians with a number of other medicines which are principally astringents, bitters and aromatics. As examples of such preparations we may mention the *Kutajaleha* or confection, and the *Patháдya churna* or compound powder of Chakradatta. In the *Pradaráni lauha* the drug is combined with iron, but perhaps the most popular preparation is the *Kutajárishta* or Kutaja wine of Sarangadhara, which is made in the following manner:—Take of fresh root bark, 12½ seers, raisins, 6¼ seers, flowers of *Bassia latifolia* and bark of *Gmelina arborea* of each 80 tolas; boil them together in 256 seers of water, till reduced to 64 seers, and strain. Then add flowers of *Woodfordia floribunda* 2½ seers; treacle 12½ seers, and let the mixture ferment for a month in a cool place (it is usually buried under the ground). Draw off and bottle. This preparation has an agreeable flavour, is not bitter, and is an excellent

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remedy in chronic dysentery and diarrhœa. Plasters and oils, containing Conessi bark combined with astringents and aromatics, are also used by the Hindus. They are applied over the part of the abdomen which is most painful.

Arabic and Persian writers describe the seeds under the name of Lisán-el-asafír-el-murr, and Zabán-i-gungishk-i-talk (bitter sparrow's tongue); they consider them to be carminative and astringent, and prescribe them in chronic chest affections, such as asthma, also in colic and diuresis; besides this they attribute lithontriptic, tonic and aphrodisiac properties to them, and combined with honey and saffron make them into pessaries which are supposed to favour conception. We may mention incidentally that the use of medicated pessaries for this purpose is a common practice in India.* They are also used after delivery. According to the Makhzan, the bark is the Tiwaj (tvac?) of Persian writers, which the author of the *Tuhfat* identifies with Talisfar, by some supposed to be the Indian bark used in dysentery by the Greek physicians under the name of μάκερ.

The Portuguese physicians, Garcia and Christopher a Costa, describe the drug under the names of Coru, Curo, Cura and Corte de pala. Rheede, who calls the tree Codaga-pala, states that the bark is applied as a *lép* (plaster) in rheumatism, and that a hot decoction of it is used in toothache, and in the cure of bowel affections. Ainslie mentions the bark as having been lately admitted into the British Materia Medica, under the name of Conessi bark.

Conessi bark, also known as Codaga pala, Corte de pala, and Tellicherry bark, enjoyed for a time considerable repute in Europe. It has however fallen into disrepute, principally, according to Sir Walter Elliot, who regards it as one of the most valuable medicinal products of India, from the comparatively inert bark of *W. tinctoria* having been confounded with it. Favourable reports of its use as a remedy in dysentery will be found in the *Pharmacopœia of India*. For ad-

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* Similar pessaries were used by the Greeks and **Romans**.

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ministration Mr. O. C. Dutt prefers a watery extract of the root bark, of which the average dose is about three grains in combination with half a grain or more of opium.

Other European physicians have preferred the powdered bark, or a decoction made with 2 oz. of the bark to 2 pints of water, to be boiled down to one pint. The impure alkaloid (wrightine) is bitter, and has been used with some success as an antiperiodic, and in the treatment of dysentery occurring in aged persons and infants. It is sold by druggists in Calcutta.

For an exhaustive analysis of the botanical confusion which has arisen in connection with this plant and the various species of Wrightia, we would refer our readers to an article by M. R. Blondel (*Nouveaux Remédes*, Sept. 24, 1887,) in which the botanical history and structure of *Holarrhena antidysenterica* is fully discussed and illustrated.

Description.—Three Apocynaceous plants are frequently called *Kura*, *Koda* or *Kuda* in the Indian vernaculars; *Holarrhena antidysenterica*, *Wrightia tomentosa*, and *Wrightia tinctoria*. They may be distinguished most readily by an examination of the follicles and seeds. *H. antidysenterica* has the pair of follicles separate, *W. tomentosa* has them connate, separating when quite ripe, and *W. tinctoria* has follicles connected at the apex only. In Holarrhena the seeds have a tuft of hairs on the end most remote from the foot-stalk, whilst in the Wrightias the tuft is on the end next the foot-stalk.

The young bark of Holarrhena is grey and nearly smooth; on the older branches it is externally of a brown colour, and scarred from the exfoliation of portions of the suber; internally it is of a cinnamon colour, and the cambium layer when present smooth and nearly white. The root bark resembles that of the older stems, but is of a deeper and more rusty brown colour.

The seeds resemble oats, are very bitter, and are contained in long follicles about the thickness of a quill. They are of a yellowish brown colour, about 2 centimetres long and 2 to 3 millimetres thick; at one end of the seeds is a kind of shallow neck, to the sides of which was attached the tuft of hairs. One side of the seed is grooved, and in this groove may be seen the raphé. The outer envelope of the seed is thin and papery, and within it is a thin white layer of albumen. The embryo consists of a conical radicle and two foliaceous convoluted cotyledons.

Microscopic structure.—A section of the bark from the larger branches is remarkable for several layers of rhytidoma, the inner of which is in contact with the cambium; this structure gives rise to exfoliations of portions of the outer layer of the bark. Simple and branched laticiferous vessels are to be seen, and a few groups of stony cells. The cells of the parenchyma are filled with starch granules and contain red colouring matter. Externally there is a thin layer of suber. In the young bark the rhytidoma is not developed, consequently there is no exfoliation.

Chemical composition.—The bark and seeds contain a basic substance (*Wrightine*), to prepare which the pulverised seeds are treated with carbon bisulphide in a displacement apparatus to remove a fat oil, then dried and exhausted with hot alcohol; the extract freed from alcohol by distillation, is digested with a small quantity of dilute hydrochloric acid, and the evaporated filtrate is mixed with ammonia or sodic carbonate, which throws down a copious flocculent precipitate, consisting of the impure base.

Wrightine after washing with cold water forms an amorphous powder, insoluble in ether and in carbonic disulphide, soluble in water and alcohol, and especially in dilute acids, with which it forms uncrystallisable salts having like the base itself a persistent bitter taste. The acetic acid solution is precipitated by tannic acid; the hydrochloric acid solution gives flocculent precipitates with platinic, auric, and mercuric chlorides. (*Stenhouse, Phar. Jour.* (2), V., 493.) R. Haines (*Ibid.*, VI., 432) states that he obtained the same base from Conessi bark in 1858, and gave a short description of it in the *Transactions of the Medical and Physical Society of Bombay* (New Series, IV., 38). He proposed to call it *Conessine*, and calculated, from the analysis of the free base, and of the platinum salt, the formula $C^{25}H^{22}NO$. The seeds have recently been again investigated by Herr Warnecke (*Berichte*, XIX., 60), who has obtained from them a crystalline alkaloid by exhausting them with ether containing a little hydrochloric acid, digesting the extract with water and precipitating with ammonia, washing the yellow flocculent precipitate with water, and then after drying it over sulphuric acid dissolving it in petroleum spirit and evaporating. The pure alkaloid is described as occurring in delicate colourless anhydrous needles, having a bitter taste, becoming yellow at 60° to 70° C., and melting at 122° C. The alkaloid readily forms salts with acids, the hydrochlorate being crystalline. It is difficultly soluble in water, but freely soluble in alcohol, ether, chloroform, petroleum spirit, benzol, amyl alcohol, and carbon bisulphide. An analysis gave figures corresponding with the formula $C^{11}H^{18}N$. Herr Warnecke therefore claims that this base, for which he prefers the name "Wrightine" is the first discovered solid non-oxygenated alkaloid occurring in nature; in this, however, he is hardly correct, since the formula $C^{46}H^{20}N^{4}$ was attributed in 1861 to a base isolated by Rieth from the bark of *Arariba rubra* (*Annalen*, CXX., 247), which was also obtained crystalline.

Rather curiously, but simultaneously with the publication of the above-mentioned communication, another appeared by Messrs. Polstorff and Schirmer (*Berichte*, XIX., 78), which described the results of the chemical examination of a bark forwarded from Tropical Africa by German missionaries as a remedy against dysentery, and referred to *Holarrhena africana*, DC. They report that they have isolated from this bark minute proportions (one-tenth per cent.) of an alkaloid that they consider to be identical with that separated by Professor Haines from East Indian conessi bark; and they attribute to it characters closely resembling those described by Herr Warnecke as

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pertaining to the alkaloid obtained by him from *Wrightia antidysenterica* seeds. Like that alkaloid also, though crystallizable, it contains no oxygen, the formula by which it is represented being $C^{12}H^{20}N$ or differing by CH^2 from the formula given by Herr Warnecke for his alkaloid; but Messrs. Polstorff and Schirmer think their formula $C^{12}H^{20}N$ is fairly comparable with that of Professor Haines for conessine from East India Conessi bark, $C^{25}H^{22}NO$ (old notation), since the free base has the peculiarity (also shared by Aribine) of crystallizing with a molecule of water; and they think that his combustion was probably made with imperfectly dried alkaloid. It will be observed that Professor Haines and Messrs. Polstorff and Schirmer operated upon the bark of the respective plants, whilst Herr Warnecke used the seeds. So that at present there is some doubt whether both barks yield an identical alkaloid, differing in composition from that from conessi seeds by CH^2, or whether it is the alkaloid from the East Indian and African plants that differ, but are homologous. Messrs. Polstorff and Schirmer have prepared and described several salts of their alkaloid. It may be added that there is a remark in the Appendix to the Indian Pharmacopœia to the effect that probably *Holarrhena* (*Wrightia*) *antidysenterica, H. Codaga, H. pubescens* and *H. malaccensis,* are only varieties of one species, and are endowed with similar, if not identical, medicinal properties. It appears desirable, therefore, that the investigation should be extended to the bark and seeds of those plants. (*Pharm. Journ., Feb.* 27, 1886.)

Commerce.—The bark and seeds are both articles of local commerce. Value, bark, Rs. 1½ per maund of 37½ lbs.; seeds, Rs. 25 per maund.

Wrightia tinctoria, *Br., Wight Ic.,* t. 444; *Bot. Reg.* t. 933, a native of Central India, the Western Peninsula and Burma, which has already been mentioned in connection with the last article as a kind of *Kura*, affords a bitter bark which is frequently substituted for true Conessi bark; its seeds also are an article of commerce under the name of *sweet indarjau.*

This shrub is often cultivated in gardens on account of its fragrant, white, jasmine-like flowers, which are offered in the Hindu temples. It would appear to have been confounded by Garcia d'Orta with Holarrhena, as he states (*Coll.* 27) that the flowers of Coru smell like Honeysuckle, whereas those of Holarrhena are odourless. The leaves of this plant, which turn black when dry, afford a kind of indigo called in Mysore *Pala Indigo.* An account of the preparation of this dye appears in Buchanan's "Journey through Mysore, &c.," 1, 473. The coagulated milky juice forms a kind of caoutchouc; the wood is valued by turners, who call it Dudhi, "milk wood."

The bark may be distinguished from true Conessi bark by its darker colour, and by its not exfoliating in patches (absence of rhytidoma); the seeds by their want of bitterness. The bark is used as a tonic and the seeds as an aphrodisiac; both are articles of commerce, the former being more frequently met with in the shops than true Conessi bark. The seeds are sold at about Rs. 4 per maund of 37½ lbs.

NERIUM ODORUM, *Soland.*

Fig.—*Bot. Mag.*, 1799, 2032; *Bot. Reg.*, *t.* 74; *Rheede Hort. Mal. iv.*, *t.* 1, 2. Oleander (*Eng.*), Laurier Rose (*Fr.*).

Hab.—W. Himalaya, Central India, Sind. Cultivated all over India. The root.

Vernacular.—Kaner (*Hind., Guz., Mar.*), Karabi, Kaner (*Beng.*), Alari (*Tam., Mal.*), Gannèru (*Tel.*), Kanigila (*Can.*).

History, Uses, &c.—In Sanskrit medical works two varieties of Karavira are mentioned, namely, Svetapushpa, "white-flowered"; and Raktapushpa, "red-flowered." Other well known Sanskrit names for the Oleander are Asvamáraka "horse-killer," and Pratihasa "laughing." In the Nighanṭas both kinds are described as hot and poisonous; they are said to be of use as an external application to swellings, leprosy and skin diseases such as itch. The flowers of the red and white Oleander are much used by the Hindus in religious ceremonies.

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De Gubernatis states that the *N. Oleander* is called in Italy *Ammazza cavallo* or *Ammazza l'asino*, and remarks that this accounts for the dread of its presence shown by the ass of Lucian and Apuleius. (*Myth. des Plant.* ii., 259.)

For external application the Hindus make a strong decoction of the root and boil it down with oil and cow's urine until the water has been driven off, other drugs are usually added, such as Plumbago root, Embelia seeds, &c.

The root of Oleander beaten into a paste with water is recommended by Sarangadhara to be applied to chancres and ulcers on the penis. According to Chakradatta the fresh juice of the young leaves is dropped into the eyes in ophthalmia with copious lachrymation. In Arabic and Persian works the plant will generally be found described under the name of Difli; other names are Sum-el-Himár and Kharzahrah, which both signify Asses'-bane; it is identified with the Nerium of the Greeks.* The Mahometan physicians describe it as a most powerful resolvent and attenuant, only to be used externally; taken internally it acts as a poison upon men and animals. A decoction of the leaves is recommended to reduce swellings, and an oil prepared from the root bark in skin diseases of a scaly nature and in leprosy. Mír Muhammad Husain says that the Oleander is poisonous to insects, and that it cures itch. He also states that the leaves though poisonous to all four-footed animals are a counter-poison against serpents. The latter statement appears to be copied from Pliny. (*Hist. Nat.* 24, 2.) Ainslie informs us that the bark of the root and leaves are considered by the Vytians as powerful repellants, applied externally. The active principles of *N. odorum* are powerful heart poisons. 0·0016 grams of *Neriodorein* injected hypodermically into a large healthy frog caused in 14 minutes diminution of the heart beats from 70 to 12 per minute, followed by a temporary rise to 60; after the lapse of five minutes longer the heart ceased to beat. This cessation of the heart's action was closely followed by cessation of the respiration. According to Fraser (*Trans. Royal Soc. Ed.* xxiv.) oleander like digitalis, &c., produces at first irregularity and acceleration of the heart's action, then a diminished frequency caused by protraction of the ventricular systole, and, finally, stoppage of the contractions by cessation of the dilation of the ventricles, which remain contracted, white and perfectly empty.

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* Nerium Oleander, hardly different from the Indian plant. Conf. Dios. περὶ νηρίου iv., 80. It was also called by the Greeks and Romans Rhododaphne and Rhodadendron.

Description.—Roots crooked, bark thick, soft, external surface grey, corky, on young roots the corky layer is very thin, and the interior yellow colour of the bark is seen through it, inner surface yellow. The bark when cut or wounded exudes a pale yellow latex, which is resinous and very sticky. Odour somewhat acrid. Taste acrid and bitter.

Microscopic structure.—In the bark of the roots the medullary rays are very numerous; their being loaded with yellow resinous juice makes them very conspicuous. The laticiferous vessels are numerous and generally in groups of two, three, or more. The wood is very porous, and abounds in large dotted vessels. Both bark and wood abound in starch.

Chemical composition.—Mr. H. G. Greenish has extracted from the bark of *N. odorum* two bitter principles, one soluble in chloroform and little soluble in water, to which he has given the name *Neriodorin*, and another very soluble in water and insoluble in chloroform, which he has named *Neriodorein*. Both of these substances are powerful heart-poisons. Neriodorein is an amorphous powder of a pale yellow colour, and very bitter taste, insoluble in petroleum spirit, ether, benzol, chloroform, sulphide of carbon, amylic alcohol, and acetic ether, but readily soluble in water and alcohol. It contains no nitrogen; a watery solution is neutral to test paper. Chloroform partly separates it from its watery solution in the form of an oily liquid. Chloroform and ether precipitate it from an alcoholic solution in a flocculent condition. It is soluble in glacial acetic acid, the evaporation of the solvent leaves a yellow amorphous varnish-like mass. Although the aqueous solution passes through the dialyser it has not yet been crys-

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tallised. Concentrated sulphuric acid colours it of a brownish red with a violet tinge round the edge of the mixture, gradually the mixture becomes yellow, passing to brown and green. In the presence of sugar strong sulphuric acid produces a brownish red colour passing to violet. Heated in a closed tube with 2 per cent. of hydrochloric acid for two hours, neriodorein is decomposed into a yellow resinous substance; it appears to be a glucoside. Neriodorin is a transparent yellow, varnish-like substance which cannot be pulverized even after drying over sulphuric acid under the air pump; it is very soluble in chloroform, scarcely soluble in cold water, but much more so in hot water; its watery solution is bitter. It is insoluble in petroleum spirit, benzol and bisulphide of carbon; ether only dissolves a trace. It is very soluble in alcohol, contains no nitrogen, and is uncrystallisable. In other respects it closely resembles Neriodorein. (*Phar. Jour., April 23rd*, 1881.)

Toxicology.—The leaves of *Nerium Oleander* were examined by Leukowsky (*N. J. Pharm.* 46, 397), who announced the presence in them of two alkaloids, *Oleandrine* and *Pseudocurarine*. Schmiedeberg (1883), who considers oleandrine to be a glucoside, found in the leaves two other glucosides, *Neriine* and *Neriantine*: he considers neriine to be identical with digitaleine. M. E. Pieszczek (*Archiv. d. Pharm.* (3), xxviii., 352, 1890,) obtained from the bark a glucoside having the composition 62·324 per cent. Carbon, 8·066 per cent. Hydrogen, and 29·610 per cent. Oxygen, which he found to be very poisonous, having an action similar to that of strychnine: 4 cgr. proved fatal to a rabbit in three-quarters of an hour. He has named this glucoside *Rosaginine* from *Cortex Rosaginis*, the German name for oleander bark. M. Pieszczek also obtained from the bark the neriine of Schmiedeberg, the composition of which he found to be 54·252 per cent. Carbon, 7·570 per cent. Hydrogen, and 38·178 per cent. Oxygen. If a portion of neriine is dissolved in strong sulphuric acid, and the vapour of bromine is made to pass over the mixture, a splendid violet-purple colour is produced. The bark was also found to contain

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an essential oil of disagreeable odour, and a crystalline body, the aqueous solution of which has a fine blue fluorescence, especially after the addition of an alkali. This latter substance was only found in old bark.

Toxicology.—Chevers (*Med. Juris. for India*) refers to the toxicology of the drug at length, and states on the authority of Honigberger that the root of the hill plant is more toxic than that grown in gardens; he remarks that it is proverbial among females of the hills, when quarrelling, to bid each other go and eat the root of the *Kaner.* Ainslie also refers to its use by Hindu women when tormented by jealousy, and Broughton says that it is well known and extensively used in the Bombay Presidency as a poison, the juice from the red variety being considered the strongest and most fatal. It is also stated to be much used as a poison in the Umballa district, the root sometimes being given in coffee. Dr. Cleghorn (1868) records the history of two male adults who were found dead in the house of a prostitute. The woman confessed that she had given them the powdered root of *Kurrubee* in milk as a cure for gonorrhœa, from which they were suffering, the root being a popular remedy for venereal and skin diseases. Soon after taking the mixture, the men became sick, vomited, and complained of pain in the abdomen, writhed about the floor, and latterly became sleepy. On *post-mortem* examination the following points were noted:—

Brain.—In one case engorgement of venous sinuses; puncta sanguinea abundant: otherwise apparently normal. In the other case the brain is reported as apparently healthy.

Heart.—In one case vessels on exterior surface congested, right ventricle distended with dark fluid blood; valves, &c., healthy. In the other case, two ounces of serum were found in the pericardium, and both ventricles were filled with fluid blood.

Lungs.—In one case no information recorded: in the other returned as healthy.

Stomach.—In one case congestion of vessels on posterior surface of great curvature: a well defined spot of congestion on posterior surface of cardiac end: a similar patch near pyloric orifice: contents grumous, fluid. In the other case, well marked spots of congestion on the anterior and posterior surfaces of peritoneal coat, covering cardiac end: mucous surfaces corresponding to these being covered with specks of stellate congestion: contents grumous, fluid.

Liver.—In one case large vessels congested, otherwise normal. In the other case, enlarged: large veins filled with blood.

Spleen.—In both cases enlarged: probably by malarious fever.

Intestines.—In one case mucous coat of small gut throughout of a dark colour: large veins distinct. Large patch of congestion on upper part of mucous surface of duodenum, surface velvetty: spots of congestion scattered through jejunum and ileum: villi well marked in upper part of jejunum: large spots of congestion in inguinal flexure. In the other case, the bowels were reported as normal, except that in parts the vessels were congested.

Kidneys.—Intensely congested in one case, healthy in the other.

Æsophagus.—In one case covered with dark-coloured mucus; in the other the upper part of fauces covered with blood.

No chemical examination of the viscera was made. In 1843, a case of fatal poisoning by the root was sent to the Chemical Examiner, Bengal, by Dr. Greig, in which the bark had been taken from the roots of a plant in the doctor's own garden, beaten to a powder, and then administered mixed with oil. It was judged that at least two or three ounces of the bark had been taken. About 1½ hour after the poison had been taken, the patient was apparently senseless and unable to answer questions: the pulse was preternaturally slow and soft but regular, with an inclination to stop: a considerable amount of the mixture was stated to have been vomited soon after it had been taken. Warm water and an emetic was administered, which induced free vomiting, and the patient was ordered to be moved about. Under this treatment he revived consider-

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ably, but relapsed into insensibility some hours afterwards. The patient appears to have recovered from all urgent symptoms, but to have died suddenly on the following day after making some exertion. On *post-mortem* examination 5 hours after death, the cavities of the heart were filled with black fluid blood. The lungs were natural. The stomach contained a quantity of dark yellowish fluid, and on its internal surface, near the cardiac and pyloric orifices posteriorly were found small patches studded with red points, and one or two slight abrasions of the mucous membrane. The liver appeared somewhat distended, and the intestines and spleen are reported natural.

Mr. Broughton (*Trans. By. Med. & Phys. Soc.* for 1857-58, p. 4,) reports a case in which a slight and delicate male drank a little more than an ounce of the expressed juice, walked five yards and fell senseless. When seen in the morning, the face and eyes were flushed, head hot and perspiring, with stertorous breathing and foaming at the mouth, accompanied by violent spasmodic contractions of the muscles of the entire body: more remarkable in the upper than lower extremities, and on the left than right side. During intervals of spasm, the patient lay evenly upon his back, when an attack occurred, the superior contractions of the left side threw him over on his right, in which position he remained during the paroxysm. Insensibility continued, and the spasms returned at intervals of an hour, and were induced by attempts to rouse or move the patient: the bowels were moved involuntarily. Towards evening the spasms decreased, the face became pale, the pulse a thread, the eyes shrunk and the extremities cold: stimulants restored the circulation, but insensibility continued, and the bowels were moved involuntarily. In the evening reaction set in, the skin became hot, the pulse frequent: there was no spasms but insensibility was still complete. On the morning of the following day the patient was restored to speech and reason.

The following case was treated in the Medical College Hospital, Calcutta, and reported in the *Ind. Med. Gazette,*

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September, 1866. A male adult was brought to hospital in an apparently unconscious state, the trunk and limbs being rigid, and the jaw spasmodically closed, the pulse very feeble, and exceedingly slow, about 30. The history was to the effect that 5 hours previously more than ¼ tola (45 grains) of the fresh root bark of *Sheth Kurrubee* (white oleander) rubbed up with black pepper had been taken. Within half an hour the patient began to feel giddy and very heavy, and was obliged to lie down: this was shortly followed by a general uneasy sensation and considerable restlessness. Soon afterwards fits occurred, in which the trunk and limbs were rigid and contracted, the hands clenched and thumbs flexed inwards on the palms. Profuse perspiration and a sensation of constriction round the chest also accompanied each paroxysm. In hospital the patient had no regular paroxysm, but constant muscular twitchings were observed all over the body, and continued for four or five hours after admission. The rigidity of the muscles gradually wore off, and on the morning after admission the patient declared himself quite easy save for a slight heaviness about the head. The patient stated that he had never lost consciousness, and that his mind had been quite clear. Babu K. H. Acharjee (*Ind. Med. Gaz.*, 1866,) reports the case of a boy, to whom the powdered root had been administered for intermittent fever. In three or four hours he was attacked with tetanus, and was found free from fever, quite sensible, the jaws spasmodically closed, and the muscles of the body rigid and contracted. The patient recovered. Babu D. Mookerjia draws attention to the tetanic symptoms which may occur in oleander poisoning, as evidence that the action of the poison resembles that of strychnia, and he remarks, in the case last mentioned, that all the urgent symptoms (as in strychnia poisoning) were developed suddenly, and the muscles of the jaw were likewise the last to be affected: when the symptoms began to subside, they did so rapidly. He also adds—the marked difference between the effects of oleander and nux-vomica poisoning consists in the condition of the pulse. In nux-vomica poisoning it is generally unaffected, becoming slightly quickened only during a fit; but in oleander poisoning its preternatural slowness is a marked feature.

In Madras oleander pounded with giugelly oil is a favourite poison with suicides. The Madras Chemical Examiner's Report for 1882-83, mentions three cases; for 1883, two cases; for 1885, one case. They were all suicides, the root was detected by its physical characters in the vomited matters.

In the whole of India, during the fifteen years ending 1888, the reports of the Chemical Examiners record 29 detections of oleander,—namely, Bengal, 2; N.-W. Provinces, 2; Madras, 11; Bombay, 14. Two of the detections in Bombay were in connection with cattle poisoning.

THEVETIA NERIIFOLIA, *Juss.*

Fig.—*Bot. Mag.* 2309; *Lyon, Med. Juris. for India*, p. 298. Exile or Yellow Oleander (*Eng.*).

Hab.—West Indies Cultivated in India. The bark.

Vernacular.—Pila-kanér (*Hind.*, *Guz.*), Kolkaphul (*Beng.*), Pachchai alari, Tiruvachchippu (*Tam.*), Pachcha-gannéru (*Tel.*), Pachcha-arali (*Mal.*), Pivala-kanér (*Mar.*).

History, Uses, &c.—This plant is commonly cultivated in India as an ornamental garden shrub.

Descourtilz, in his *Flora of the Antilles*, speaks of *T. neriifolia* as an acrid poison, of the bark as a drastic purgative, of the fruit as emetic, and of an extract of the plant as a remedy for intermittent fever. He describes the case of a young negro who had eaten of the green fruit, and who was affected with chills, delirium, and other nervous symptoms, nausea, and a thready pulse; he had irregular spasms, followed by extreme agitation, with singing, laughing, and weeping, and then by a fixed blank look. He seemed tending to coma, but was relieved by an emetic.

The antiperiodic properties of the bark have been confirmed by Dr. G. Bidie (*Madras Quart. Med. Journ.* v., p. 178), and Dr. J. Shortt (*Ibid.*, viii., p. 294).

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Their trials with it in various forms of remittent fever proved highly satisfactory, and leave little doubt that it is a remedy of considerable power. It was employed in the form of tincture (one ounce of the freshly-dried bark macerated for eight days in 5 ounces of rectified spirit) in doses of from 10 to 15 drops thrice daily. In larger doses (30 to 60 drops), it acts as an acrid purgative and emetic, and carried to a greater extent is evidently powerfully poisonous. The kernels are extremely bitter, and when chewed produce a slight feeling of numbness and heat in the tongue; by expression they yield a clear, pale amber-coloured, slightly viscid, acrid oil, which is sometimes recommended as a cathartic by the natives, but, according to Dr. Shortt, it produces violent vomiting and hypercatharsis. (*Pharm. of India*, p. 138.) This, however, is contrary to our experience; the oil *when pure* is as inert as olive oil.

Dr. A. J. Amadeo of Porto Rico states that two grains of the extract of the bark, given in the apyrexia of intermittent fever, prevent the access of the paroxysm, and that the natives employ the bark in infusion for the cure of ague. (*Pharm. Journ., April*, 1888.)

The active principles of the plant *Thevetin* and *Theveresin* have been thoroughly tested in experiments on animals by Blas and by T. Husemann (*Archiv für exp. Pathol. u. Phar.*, v. 228). The former has upon frogs the same effects as digitalin, and its lethal dose is also nearly the same (gm. 0·001—0·003). It first hurries the respiration and renders it irregular, and kills by producing a tonic contraction of the ventricle of the heart, with a corresponding engorgement of the auricle and of the general circulation. Voluntary motion is not destroyed, although motility is impaired in the hind legs. The same effects, essentially, were produced by theveresin in the dose of gm. 0·05. Experiments upon dogs and rabbits led these observers to recognize a strong analogy between the effects of these glucosides and the effects of digitalin, helleborin, and other analogous products. They produce repeated attacks of vomiting (in dogs), and sometimes watery diarrhœa and profuse salivation, with extreme prostration, so that the animal lies still and will not change his posture except during the efforts at vomiting. The cerebral functions seem to be impaired, at least at the beginning of the attack; later, when exhaustion has become complete, the animal remains motionless, as if narcotized. The breathing is laboured, but the pupils are unchanged, and muscular tremor is constant, although spasms are either absent or only occur just before death. As above stated, in animals killed by these poisons the ventricle is contracted, yet in exceptional cases it is found dilated with dark blood. The vomiting produced by thevetin is doubtless due in part to its irritant qualities, for when it is injected hypodermically the punctures are apt to produce abscesses. The venous congestion of the stomach, which gives the interior of the organ a blue colour, is partly due to the cardiac obstruction and partly to the repeated efforts at vomiting. According to Prof. Carpio (*Phila. Med. Times*, ix. 396), the thevetin of *Thevetia Yccotli* produces symptoms almost identical with those above described, and kills by arresting the heart either in diastole or in systole The experiments of Cerna (*Ibid.*, p. 426,) led him to the following among other conclusions: Thevetin produces death by asphyxia and by cardiac paralysis; applied to the skin, it irritates, with a sensation of burning; it produces convulsions of cerebral and paralysis of spinal origin; increases intestinal paralysis; lowers the temperature; locally applied, it contracts the pupil; and it increases salivation. Warden has confirmed the statement as to the production of convulsions. (*Amer. Jour. Phar.*, liv. 301.)

Description.—The fresh bark of the young wood, of from ½ to 1 inch in diameter, is green, smooth, and covered by a thin grey epidermis, through which thegreen colour is apparent; it turns black when dry. The bark from the larger stems has a brown suberous coating; the wood is white and soft, with a large central pith. All parts of the plant yield an abundance of acrid milky juice. The fruit is globular, slightly fleshy, green, 1½ to 2 inches in diameter, and contains a hard nut, light brown in colour, and triangular, with a deep groove along the edge corresponding to the base of the triangle; each nut contains two pale yellow, slightly winged seeds. The seeds and the inner layer of the bark give, when boiled with hydrochloric acid, a deep blue or bluish-green colour.

Chemical composition.—De Vrij has obtained from the kernels of the seeds from 35·5 to 41 per cent. by expression and 57 per cent. with benzol of a limpid almost colourless oil. The oil had an agreeable mild taste like that of fresh almond oil; its density at 25° C. was 0·9148, and at that temperature it was perfectly liquid and transparent, at 15° C. it became pasty, and at 13° C. entirely solid. Oudemans found it to consist of 63 per cent. triolein and 27 per cent. tripalmitin and tristearin. After expression of the oil De Vrij obtained from the cake about 4 per cent. of a beautiful crystallised white glucoside, to which he gave the name of *Thevetin.* A solution of 1·14 gram. of thevetin in glacial acetic acid to a volume of 10 cubic centimetres yielded in the polarimeter a levogyre rotation of 9·75°. With concentrated sulphuric acid thevetin yields a clear, dark yellow liquid, which by exposure to the air assumes after a few minutes a beautiful purple colour. This colour disappears after some time under separation of a flocculent matter. Nitric acid yields no reaction with thevetin at the ordinary temperature. De Vrij has also found thevetin in the bark of the shrub. (For a further account of thevetin and theveresin, see a paper by Dr. Blas in the *Transactions of the Académie des Sciences de Belgique* (3) 2, No. 9—.) Warden has described a principle contained in the seeds which he called *pseudo-indican,* and which affords a blue coloration with hydrochloric acid: he points out that this reaction might be utilized in toxicological investigations. (*Pharm. Journ.*, Nov. 1881.) In another communication to the same journal, he refers to the presence of a second toxic principle in the seeds, which he considers to possess greater toxic powers than thevetin. (*Pharm. Journ. xiii.*, 182-183.)

Toxicology.—Dr. Kanny Lal Dé has drawn attention to the use of the seeds as a poison in Bengal, but erroneously ascribes their toxic properties to the bland oil. Dr. Dumontier has published an account of the death of a child three years of age after eating one seed. An interesting case of poisoning by one of the seeds is recorded by Dr. J. Balfour (*Madras Journ. of Lit. and Science, iii., N. Ser.*, p. 140). Recovery ensued. Dr. Lyon (*Med. Juris.*, p. 299) mentions a case in which eight to ten seeds proved fatal to an adult female: he remarks that cases of poisoning in the human subject are seldom met with in India, but of late years the seeds have come into somewhat extensive use in the Bombay Presidency as a cattle poison, nine cases of this kind having been reported in the Bombay Chemical Analyser's Office during the year 1886. In Bengal four other cases are on record, but the particulars of one only are given, in which a woman attempted to commit suicide.

CERBERA ODOLLAM, *Gärtn.*

Fig.—*Wight Ic.*, t. 441; Lyon's *Med. Juris. for India*, p. 300.

Hab.—Swamps and creeks on the coasts of India and Ceylon; Sunderbuns. The seeds.

Vernacular.—Odallam (*Mal.*), Katarali (*Tam.*), Honde (*Can.*), Sukann (*Mar.*), Dabúr, Dhakur (*Beng.*).

History, Uses, &c.—This is a handsome tree, very plentiful along the backwaters of the western coast. Emetic and purgative properties are assigned to the milky juice, bark and leaves, and the action is very similar to that of *Thevetia neriifolia*. The kernel of the seeds is frequently resorted to in criminal poisoning in the Madras Presidency, and in the native states of Travancore and Cochin. The fruit combined with datura is a part of the remedy given by native physicians for hydrophobia. The bark affords a fibre. The seeds yield 55·5 per cent. of a bland fixed oil, of a pale yellow colour, which is used for burning and for anointing the head; it contains no poisonous property if obtained by expression or by means of petroleum ether.

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Description.—The ripe carpel is ovoid, 2 to 4 inches long, somewhat resembling a green mango, fibrous and woody within, and contains a single broad, compressed, white seed, consisting of two irregularly attached oily cotyledons.

Chemical composition.—Dr. de Vrij has separated from the kernels a crystalline poisonous glucoside, probably the same as thevetin, and an alcoholic extract of the seeds when treated with hydrochloric acid gives a blue or bluish-green colour as exhibited by Thevetia.

Professor Plugge, of Groningen, has made an investigation of the seeds with the following preliminary results. 25 grams of the powder, partially separated from oil by expression, were entirely freed from oil by extraction with benzol, and the remaining powder afterwards extracted with alcohol. From this alcoholic solution it was impossible to obtain any crystalline body, although the solution contained a very poisonous principle. The alcohol was evaporated, and the resulting syrup was dissolved in a few c. c. of water. With this solution subcutaneous injections were made on frogs, and it was found that 0·5, 0·2, 0·1, and even 0·05 c. c. caused death in from five minutes to one hour. The symptoms are chiefly—(1) stoppage of the respiration, or in smaller doses, irregularity of the respiration; (2) violent and repeated vomiting; (3) general paralysis; and (4) finally stopping of the heart in contraction (systole). It seems that the poisonous principle of Cerbera seeds is not only a strong poison of the heart, that, like digitalin, stops the heart in systole, but also has a very marked action on the respiration. The watery solution of *Cerberin* (?) was not precipitated by alkaloid-reagents, with the exception of phosphomolybdic acid. The principle can be best separated from the watery solution of the alcoholic extract, by first shaking it with petroleum ether, and then removing the cerberin with chloroform.

The oil of the kernels has a specific gravity of 9194 at 15·5° C.; at a few degrees below this temperature it deposits solid fats. The saponification equivalent is 259·4, and after decom-

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position of the soap, there is left 95·5 per cent. of insoluble fatty acids melting at 34°. The elaïdin reaction resulted in the solidification of the oil in one hour, and after 24 hours it became so firm as to hardly yield to the pressure of the finger. The ash of the seeds amounts to 3·3 per cent.

Toxicology.—Cases of poisoning with the seeds of Odallam are brought to the notice of the medical officer at Trevandrum every year; they act as an irritant poison by producing vomiting and purging, soon followed by collapse and death. In 1885, out of four cases, one was fatal; in 1886, seven cases were reported. The nut is occasionally eaten by children in mistake, but it is mostly used intentionally by women who wish to commit suicide when they get into trouble. The Madras Chemical Examiner in 1888 reported the case of a boy who, after eating the kernel, "suffered from vomiting and tingling of the skin and throat, deep sleep, and twitching of the muscles, and died in 16 hours." A part of the fruit sent with the viscera was identified.

Pao Pereira.—Under this name the Portuguese in India use the intensely bitter bark of *Geissospermum læve*, which they obtain from Brazil, as a febrifuge and tonic.

Santos (1838) separated from it an alkaloid, *pereirine*, which in its impure state, as a brown-yellow amorphous powder, is employed in Brazil. Bochefontaine and De Freitas (1877) proposed to call it *geissospermine*, and Hesse (1877) adopted this name for the alkaloid, which is nearly insoluble in ether and water and readily soluble in alcohol and dilute acids; it crystallizes in small white prisms, dissolves in strong nitric acid with a purple-red colour, becoming orange-yellow on heating, and in concentrated sulphuric acid at first colourless, rapidly changing to blue, and gradually to a pale colour; its composition is $C^{19}H^{24}N^{2}O^{2}H^{2}O$. A second alkaloid, *pereirine*, is easily soluble in ether, forms a greyish-white amorphous powder, and is coloured blood-red by nitric and violet-red by sulphuric acid; it appears to be present in larger proportion than the preceding one. (*Stillé and Maisch.*)

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TABERNÆMONTANA CORONARIA, *Br.*

Fig.—*Wight Ic. t.* 477; *Bot. Mag.* 1861; *Rheede Hort. Mal. ii.*, 54, 55. Ceylon Jasmine (*Eng.*), Arbre-vache (*Fr.*).

Hab.—Uncertain. Cultivated in India. The milky juice and root.

Vernacular.—Tagar (*Hind., Mar., Guz.*), Nandia-vatai, Nanthia-vatai (*Tam., Tel.*), Nandi-battal (*Can.*), Karáta-pála (*Mal.*).

History, Uses, &c.—This shrub is often confounded with the Tagara of the Nighantas (see *Valeriana Wallichii*). Rheede says that the milky juice of *T. coronaria* mixed with oil is rubbed into the head to cure pain in the eyes; the root chewed relieves toothache; rubbed with water it kills intestinal worms; with limejuice it removes opacities of the cornea. It is the *Fula de S. Antonio* of the Portuguese. Ainslie (ii., 257) states that the Sanskrit name given to it in Southern India is Nandivriksha, and that it is very cooling in ophthalmia. In Western India the milk has the reputation of being very cooling, and is applied to wounds to prevent inflammation. Two wild species, *T. dichotoma* and *T. Heyneana*, are considered to have similar properties, and are known by the same vernacular names. In Pudukota the flowers are used in inflammation of the cornea. The milk of plants belonging to this genus contains caoutchouc and resins, but is generally free from acridity. *T. utilis* is the Hya-Hya or Cow-tree of British Guiana, which yields a copious supply of thick sweet milk when tapped.

Description.—A shrub 6—8 ft., much dichotomously branched, bark pale; leaves 4—6 inches by 1—1½ inch, glossy, rather coriaceous, green when dry, pale beneath, margin waved, petiole ¼—½ in., axils of petioles glandular. Peduncles 1—2 in., pedicels slender, bracts minute. Flowers pure white, often double, fragrant. Follicles 1—3 in., spreading and recurved, sessile or contracted into a sort of stalk at the base, turgidly oblong, beaked or not, 3-ribbed; seeds 3 to 6, oblong,

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striated, aril red, fleshy. (*Fl. Br. Ind.*) All parts of the plant abound in a milky juice, which has a bitter taste.

Chemical composition.—The fresh roots were extracted with 80 per cent. alcohol. From the alcoholic extract, in addition to resins and extractives, a large amount of an alkaloidal principle was isolated, soluble in ether, and giving marked precipitates with alkalies, chromate of potash, and alkaloidal reagents, but no special colour reactions were noted. The taste was bitter, and the principle as deposited by spontaneous evaporation of an ethereal solution, was in the form of a yellowish brittle varnish.

RAUWOLFIA SERPENTINA, *Benth.*

Fig.—*Wight Ic. t.* 849; *Bot. Mag. t.* 784; *Burm. Fl. Zeyl., t.* 64. Syn.—*Ophioxylon serpentinum.*

Hab.—Throughout India. The root.

Vernacular.—Chota-chand (*Hind.*), Chandra (*Beng.*), Harkai (*Mar.*), Pátala-gandhi (*Tel.*), Chuvanna-avilpori (*Mal.*), Covannamilpori (*Tam.*), Sutranabhi (*Can.*).

History, Uses, &c.—This shrub is mentioned in Sanskrit works under the names of Sarpagandhá and Chandrika. The Hindus use the root as a febrifuge, and as an antidote to the bites of poisonous reptiles, also in dysentery and other painful affections of the intestinal canal. By some it is supposed to cause uterine contraction and promote the expulsion of the fœtus. Ainslie gives the following account of it:—*Tsjovanna amelpodi* is the name given, on the Malabar Coast (*Rheede, Mal.* vi. 81, t. 47), to a plant, the bitter root of which is supposed to have sovereign virtues in cases of snake-bites and scorpion-stings; it is ordered in decoction, to the extent of a pint in twenty-four hours, and the powder is applied, externally, to the injured part. The plant is the *Radix mustela* of Rumphius. (*Amb.* vii. 29, t. 16.) The Javanese class it among their anthelmintics, and give it the name of *pulipandak.*

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It may be found noticed both by Burman* in his *Thesaur. Zeylan.* (t. 64) and Garcia ab Horto; the latter recommends it as stomachic; Rumphius speaks of it as an antidote to poisons; and Bontius, in his *Hist. Mat. Med. Ind.*, tell us that it cures fever." (*Mat. Ind.* II. 441.) It will be seen that Ainslie confounds it with the *Radix mustela* or ichneumon root (*Ophiorrhiza Mungos*), and the natives of some other parts of India appear to make the same mistake. Sir W. Jones (*Asiat. Research.* iv., p. 308,) thinks it possible that this plant may perhaps be the true ichneumon plant. In the *Pharmacopœia of India* its use in labours to increase uterine contractions is noticed upon the authority of Dr. Pulney Andy, but we have no other evidence of its efficacy in such cases. In Bombay most of the labourers who come from the Concan keep a small supply of the root, which they value as a remedy in painful affections of the bowels. In the Concan the root with *Aristolochia indica* (Sápsan) is given in cholera; in colic 1 part of the root with 2 parts of *Holarrhena* root and 3 parts of *Jatropha Curcas* root is given in milk; in fever the root with *Andrographis paniculata*, ginger and black salt is used. The dose of the combined drugs in each case is from 3 to 4 tolás.

Description.—Root crooked, tapering, from ½ an inch in diameter downwards; bark soft, corky, marked by longitudinal fissures, light brown; wood brittle, showing rings and medullary rays visible to the naked eye; taste very bitter; odour of the fresh root acrid. The suber upon transverse section presents when magnified the appearance of a piece of honeycomb, *viz.*, alternate rows of long tubular cells and compressed cells; the inner portion of the bark consists of a delicate parenchyma, loaded with starch, and traversed by indistinct medullary rays. The wood is remarkably starchy.

Chemical composition.—The roots examined by us reduced to fine powder lost 7·18 per cent. when dried at 100° C. The ash amounted to 7·89 per cent., and was of a light chocolate colour, containing a marked amount of iron and

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a trace of manganese. On analysis the following results were obtained:—

Petroleum ether extract,		·64	per cent.
Ether	„	·346	„ „
Alcoholic	„	3·936	„ „
Aqueous	„	11·38	„ „

The petroleum ether extract was oily, yellow, and possessed an odour like that of a mixture of cedar and musk. On standing arborescent crystals separated; in alcohol the extract was partly soluble with acid reaction; the insoluble residue was oily and contained a trace of a wax. The extract afforded marked indications of the presence of an alkaloidal principle.

The ether extract was hard and had the same odour as the petroleum ether extract, but in a less marked degree. Treated with water a sightly bitter solution was obtained, which gave no reaction with ferric salts: by the action of dilute sulphuric acid an intensely bitter solution was obtained which contained an alkaloid. A yellow resin was also present.

The alcoholic extract was brittle, yellowish brown and intensely bitter. A solution in alcohol exhibited a very marked greenish fluorescence. In cold water the extract was partly soluble, with slight fluorescence, and very bitter: ferric salts gave no colour reaction. The alcoholic extract was treated with dilute sulphuric acid and the turbid acid solution agitated with chloroform: after separation of the chloroform, the liquid was rendered alkaline with ammonia, and agitated first with chloroform ether, and finally with amylic alcohol. The three extracts exhibited fluorescence when dissolved in alcohol, but the appearance was most marked in that obtained by chloroform acting on the acid solution. The chloroform extract deposited a yellowish granular mass on standing, which was non-crystalline: in taste the extract was extremely bitter: it afforded marked indications of the presence of an alkaloid, but was not wholly soluble in diluted sulphuric acid. The ether-chloroform extract was non-crystalline, it was also

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bitter, but the bitter taste was associated with some astringency; it was wholly soluble in dilute sulphuric acid, and afforded marked indications of the presence of an alkaloid.

The amylic alcohol extract was of a dark colour, and wholly soluble in dilute sulphuric acid, and very bitter: it also gave marked alkaloidal reactions. With sulphuric acid, none of the extracts afforded crystalline salts.

The aqueous extract had a bitter taste; it reduced an alkaline copper solution on boiling: with ferrocyanide of potassium and acetic acid a faint turbidity was produced. The residue insoluble in water contained a large amount of starch.

At present we do not offer any opinion as to whether the alkaloidal principles we have referred to in the various extracts are identical or not: we are also at present unable to state whether these alkaloids are new or merely principles which have already been described as occurring in other plants of the same natural order. An analysis of the root of *Ophioxylon serpentinum* by W. Bettink has been published in Haaxman's *Tijdschrift* (Jan. 1888), where no alkaloid is reported to have been found, but a crystalline body related to juglone. We feel convinced that the drug examined by Bettink was not authenticated. Prof. Eykman has recorded the discovery of an alkaloid in an Indian species of *Ophioxylon*, and later still (1890), M. Greshoff has found an alkaloid giving a veratrine reaction with Frohde's reagent, thus substantiating our analysis. It is probable that as the root resembles Plumbago root, Prof. Bettink's ophioxylin was only plumbagin.

ALLAMANDA CATHARTICA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 338. *Syn.*—*A. Aubletii*, Rohl.

Hab.—America. Cultivated in India and has run wild in the tidal backwaters of the Western Coast and at Goa.

Vernacular.—Jahari-Sontakka (*Mar.*), Arasina (*Can.*).

History, Uses, &c.—This beautiful climbing shrub is very common in gardens, and is said to have been introduced

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into India from Brazil by the Portuguese. The flowers are offered by the Hindus in their temples, and they appear to be aware of the poisonous nature of the plant, as the Marathi name signifies "poisonous Sontakka." Sontakka is the name for *Hedychium flavum*, the flowers of which have some resemblance to those of Allamanda. We have not heard of the plant being used medicinally in this country, but Ainslie (*Mat. Ind.* ii. 9,) has a short notice of it, and mentions its use at Surinam by the Dutch as a cathartic. Poupée Desportes of St. Domingo recommends the extract of the bark, in doses of 1 to 2 grains, as an excellent hydrogogue cathartic. The leaves are also said to have been used in the cure of painters' colic. In large doses all parts of the plant are violently emetic and cathartic.

Description.—*A. cathartica* has elliptic lanceolate leaves arranged in fours round the stem on very short petioles. The flowers are large, yellow, and funnel-shaped, and are borne at the ends of the branches. The fruit is globular, the size of a small walnut, and thickly set with long soft spines; it contains several flat seeds with a membranous margin. All parts of the plant abound in a thick milky juice.

Chemical composition.—The fresh leaves were pulped and digested with 80 per cent. alcohol. The green tincture was concentrated and when free from alcohol, the extract was agitated with benzole, which removed colouring matters, &c. The aqueous solution was then acidulated with sulphuric acid and agitated with ether. The extract was indistinctly crystalline, and partly soluble in water, affording a dark brownish-green coloration with ferric chloride, and precipitating an alkaline copper solution on boiling. The portion insoluble in water was dissolved by alkalies with bright yellow coloration, and reprecipitated in yellowish-brown flocks by acids. The original aqueous solution was now rendered alkaline and agitated with ether; the extract did not exceed a trace, was indistinctly crystalline, and afforded marked indications of the presence of an alkaloid. The dark brown alkaline solution was now acidulated with sulphuric acid and agitated with amylic alcohol.

The amylic alcohol extract consisted of a dark brown strongly acid glucosidal acid, soluble in water, and forming soluble compounds with alkalies, astringent matter giving a dirty greenish coloration with ferric chloride, and dark brown flocks insoluble in water, probably phlobaphene.

We injected ·495 of a gram of the amylic alcohol extract dissolved in water and a few drops of ammonia, into a fasting cat's stomach without inducing purgative effects. In another experiment we employed the dried leaves, which were extracted with alcohol, then dried, moistened with dilute sulphuric acid, and extracted with hot alcohol in the manner described by Stockman in his note on the active principle of Senna leaves (*Pharm. Journ.* [3] XV., 749). Operating in this manner we isolated a glucosidal acid which had some purgative action when injected into a cat's stomach, and which a more thorough investigation may prove to be similar to cathartic acid. The point is of some economic importance, as the plant is a very common one, and has the reputation of being a valuable cathartic.

CARISSA CARANDAS, *Linn.*

Fig.—*Wight Ic., t.* 426 and 1289; *Roxb. Cor. Pl. I., t.* 77; *Bedd. Fl. Sylv., t.* 19, *f.* 6.

Hab.—Throughout India, in dry, sandy or rocky ground. The bark, leaves and fruit.

Vernacular.—Karaunda, Karonda, Timukhia (*Hind.*), Kurumia, Karamcha (*Beng.*), Karavanda (*Mar.*), Kalaka (*Tam.*), Kalivi-kaya (*Tel.*), Karekai, Korinda (*Can.*), Karamada (*Guz.*).

History, Uses, &c.—This shrub is the Karamardaka and Krishna-phala of Sanskrit writers, and is described in the Nighantas as heavy, hot, and acid when unripe, and a generator of the three humors: when ripe it is said to be sweet, light, and digestive, and an expellant of bilious and rheumatic humors. The fruit is generally made use of by both Europeans and natives

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on account of its acid and antiscorbutic properties; when unripe it makes a good pickle and when ripe an excellent tart fruit. A jelly, similar to red currant jelly, is also made from it by Europeans. In Orissa a decoction of the leaves is much used at the commencement of febrile complaints. The root is acrid and bitterish, and is applied in the form of a paste with lime-juice and camphor as a remedy for itch and to keep off flies.

Description.—A large shrub, with many dichotomous, rigid, spreading branches; axils and nodes with two simple or forked thorns, sometimes 1 to 2 inches long. Leaves subsessile, 1½ to 3 by 1 to 1½ in., rather thinly coriaceous, base rounded or retuse, tip rarely mucronate. Drupes ½ to 1 in. long, ellipsoid, turning from green to red, then black, polished, four or more seeded. The root-bark is remarkable for its numerous large stone cells, often more than an inch in length, which form a network round the wood.

Chemical composition.—The roots were air-dried, reduced to powder, and digested with 80 per cent. alcohol. The alcohol-free extract was mixed with water, dilute sulphuric acid added, and agitated with benzole, which separated an oil of the consistence of honey at 75° F., and partly soluble in absolute alcohol with acid reaction. A trace of volatile oil was also present, with an odour similar to that of Piper Betle leaf oil. During agitation with benzole a mass of dark-yellowish resin separated, which caked. The liquid containing the separated resin was next agitated with ether. The ether extract was not more than a trace, and contained salicylic acid. The insoluble mass of resin was now separated, and the aqueous solution rendered alkaline and agitated with ether. The ether extract contained an alkaloid which gave marked precipitates with the usual reagents. The dark brown yellowish resin, insoluble in ether and benzole, was wholly soluble in ammonia, and on spontaneous evaporation left a brittle residue. The ammoniacal solution when freshly made was yellow, but on standing became green, and on spontaneous evaporation the solid residue was brownish.

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PLUMERIA ACUTIFOLIA, *Poir.*

Fig.—*Wight Ic. t.* 471; *Bot. Mag. t.* 3952; *Bot. Reg. t.* 114. Jasmine tree (*Eng.*), Frangipanier (*Fr.*).

Hab.—Uncertain. Cultivated throughout India. The bark and flowers.

Vernacular.—Khair-champa, Sufed-champa (*Hind.*), Gobarchampa (*Beng.*), Dolo-champa (*Guz.*), Khera-chapha (*Mar.*).

History, Uses, &c.— This plant is the *Flos convolutus* of Rumphius (vi. 43), who states that it is not used medicinally in Amboyna, but remarks that its juice partakes of the nature and properties of Gamboge. It appears to have been introduced into India by the Portuguese from Brazil, as it is usually planted in the churchyards of the native Christians, in order that it may deck the graves with its white deciduous flowers, which are produced almost all the year round. The Hindus make use of its flowers in religious ceremonies, and have given the Sanskrit name of Kshira-champa, "milky Champa," to the shrub. Mir Muhammad Husain describes the tree under the name of A'chin (آچین), and states that the root-bark is a strong purgative, and also a useful remedy in gonorrhœa and for venereal sores. He recommends buttermilk to be given in cases of excessive purgation after its use. Plasters made of the bark are said to be useful in dispersing hard tumours.

The natives of India frequently use the bark as a purgative and apply the heated leaves to dispel swellings, and the milky juice as a rubefacient in rheumatic pains, and with sandalwood oil and camphor to cure itch.

The flower buds are eaten with Betel leaves as a febrifuge. Dr Hové, who visited Bombay in 1787, found the plant growing abundantly on Malabar Hill, which was then uninhabited. He remarks that the natives use it in intermittents as we do Cinchona.

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Dr. A. J. Amadeo (*Pharm. Journ.*, April 21st, 1888,) has the following account of its medicinal uses in Porto Rico:—"In small doses (8 to 12 grains) given in emulsion the milk produces abundant bilious watery stools. The bark is a favourite remedy with the country people for gonorrhœa and gleet. Two ounces of the fresh powdered bark is placed in 8 pints of *eau sucrée* and exposed to the sun for four days, being shaken occasionally. A wineglassful is administered four or five times a day, together with refreshing and mucilaginous drinks, and the use of tepid baths. The action of the drug is at first purgative, afterwards diuretic. An extract of the bark may be used beginning with 3—4 grains daily to be gradually increased to 14 or 15 grains, or a wine (1 oz. to 1 litre) may be given in liqueur glassfuls three times a day. The decoction of the bark is a powerful antiherpetic.

Chemical composition.—The milky juice collected by de Vrij and evaporated to dryness at 100°, was found to yield 30·5 per cent. of residue, consisting chiefly of an organic calcium salt, a kind of caoutchouc, and resins. To isolate the calcium salt A. C. Oudemans exhausted the substance with petroleum-naphtha, and treated the residue with dilute acetic acid, which dissolved the salt, while parts of the plant and a humus-like mass remained behind. On concentrating the solution, calcium salts of different forms separate out, all, however, containing the same acid, *Plumieric*, $C^{10}H^{10}O^{5}$.

The free acid is obtained by converting the calcium salt into potassium plumierate, decomposing the latter with sulphuric acid, and extracting the solution with ether. It is readily soluble in alcohol and freely but slowly in ether. In cold water it dissolves but very sparingly, and from a hot solution it separates in microscopic crystals, or on slow evaporation in indistinct crusts. It melts at 139°, and decomposes at a temperature a few degrees higher, giving off first water and acetic acid, then an oily distillate having the odour of cinnamic aldehyde, while a small quantity of a crystalline substance sublimes. When the oil is oxidised, a crystalline acid is formed. On melting plumieric acid with potash, an acid is formed, giving the characteristic reactions of salicylic acid,

Plumieric acid is most probably a methoxyl-hydroxycinnamic acid ($C^6H^2(OH)^2(CH^2OH)(COOH)$), and forms four series of salts, according as only the carboxylic hydrogen, or in addition one or more of the three hydroxylic hydrogens, is replaced by a metal, when plumieric acid is oxidised by a dilute solution of chromic acid, it is redissolved into formic acid (or carbon dioxide) and the acid $C^9H^8O^4$, which is very sparingly soluble in water; its silver salt, $C^9H^5Ag^3O^4$, separates from a warm solution in fibrous crystals.

When plumieric acid is heated with water and sodium amalgam on a water bath, it combines slowly with hydrogen to form hydroplumieric acid, $C^{10}H^{12}O^5$, which on evaporation of its ethereal solution, separates as a varnish, becoming crystalline on standing, and freely soluble in water. (*Watts' Dict. of Chem.* viii., p.1656.)

Toxicology.—The use of this bark as a purgative is not without danger, as several cases of death from excessive purging after its use have been recorded. In a case reported in 1886, by Surgeon K. R. Kirtikar (*Trans. Bombay Med. and Phys. Soc.*) the quantity taken was about a square inch; this was pounded, mixed with water, and swallowed by a man aged 25 as a remedy for colic. The symptoms were vomiting, depressed heart's action, and somewhat dilated pupils. S. Arjun (*Bombay Drugs*, p. 210,) states that the blunt ended branches are used to procure abortion. We are not in a position to state whether plumieric acid is the active principle or not.

Ichnocarpus frutescens, *Br. Wight Ic. t.* 430; *Burm. Zeyl.*, *t.* 12, *f.*1, is an extensive climber. Leaves very variable, 2 to 3 by ¾ to 1½ inch, petiole ¼ inch, cymes 1 to 3 inches, axillary and in terminal panicles, rusty-pubescent, branches short, trichotomously divided or 3-flowered, pedicels longer or shorter than the corolla, calyx-lobes ovate, obtuse or subacute, eglandular. Corolla about ¼ inch in diameter,

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purplish, twice as long as the calyx, lobes twice as long as the tube, falcate, acuminate, mouth and margins sparingly bearded. Disc-glands, 5, erect, slender, capitate, much longer than the hairy ovary. Style very short. Follicles 3 to 6 by ⅙ inch, very slender, cylindric, curved, acute. Seeds ½ inch, very slender, not beaked; coma scanty, white. (*Fl. Br. Ind.*) The plant is described by Roxburgh (*As. Res.* 1,261) under its native name of *Syama* or *Syamalata*; it is a native of the Western Himalaya, Upper Gangetic Plain, Bengal, the Deccan Peninsula and the Southern Concan. In the Northern Concan and Guzerat it appears to be unknown. In Hindustan and Bengal it is known as Syamalata, "black-creeper," and in the Deccan Peninsula as Krishna-sáriva; the Canarese name is Kari-umbu, "black-creeper."

The roots are somewhat similar in appearance to those of Hemidesmus, but have not the same coumarin odour. The bark is of a dark brown colour, and adheres closely to the wood, which is much harder, and differs in structure from that of Hemidesmus in having a large central pith. The roots are seldom branched, but here and there a few fine fibres are given off; they are almost tasteless. For the properties and uses of this plant, the reader is referred to Hemidesmus.

Chemical composition.—The root contains a caoutchouc-like substance soluble in benzol, and a soft, brown, tenacious resin soluble in ether. Treated with alcohol the powdered root affords about 10 per cent. of dry extract, containing red colouring matter, tannic acid, and a small quantity of coumarin. The tannic acid strikes a green colour with ferric chloride, and if to this green mixture a drop of soda solution is added, a bright blue zone is seen to surround the red coloured spot formed by the alkali. This reaction is peculiar to cinchotannic acid. No alkaloidal body could be detected in this drug.

Vinca pusilla is the Kupa-veela of Rheede (*Hort. Mal.* ix. 33), who states that the plant boiled in oil is rubbed on the loins in lumbago.

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ASCLEPIADEÆ.

CRYPTOSTEGIA GRANDIFLORA, *Br.*

Fig.—*Bot. Reg., t.* 435; *Wight Ic., t.* 832, and *Ill.* ii., *t.* 182, *f.* 9; *Reichb. Ic. Exot., t.* 132.

Hab.—Africa or Madagascar. It is cultivated and has run wild in various parts of India.

Vernacular.—Viláyati-vákhandi (*Mar.*), Palai (*Mal.*).

History, Uses, &c.—This ornamental climbing shrub has been named *Vilayati-vákhandi,* "foreign Vakhandi," by the Marathas from the resemblance of its foliage to that of *Gymnema sylvestre* (Vákhandi).

It has attracted attention on account of a caoutchouc prepared from its milky juice at the botanic garden, Hyderabad, Sind, in 1882. (See *Watts' Dict. Econ. Prod. of India* ii., p. 625). We notice the plant as a case of poisoning by its leaves has been reported in the Bombay Chemical Analyser's Report for 1877-78. In this case the pounded leaves mixed with water are said to have been swallowed. Persistent vomiting came on half-an-hour afterwards, and the patient—a male adult—died in fifteen hours, apparently from exhaustion. There was no purging, and no head symptoms were present.

Description.—An extensive climbing shrub, leaves 3—4 by 1½ to 2 in., coriaceous, glossy above, nerves many, spreading, arched, faint, base acute; petiole ½ to ⅜ in.; cymes short, spreading, peduncles and branches stout, hoary or glabrous; bracts caducous; corolla pale pinkish purple, tube and throat 1½ in. long, limb often 2 in. diam., lobes acute; follicles 4—5 by 1—1½ in., broadest near the base, straight, woody; seeds ¼ in. long, oblong-ovate, compressed, narrowed upwards; coma 1½ in., very fine. (*Fl. Br. Ind.* iv., p. 6.)

Chemical composition.—The leaves contain a caoutchouc-like body (described by Warren—See *Watt's Dict. Econ. Prod.* Vol. ii., p. 625,) and afford 14·5 per cent. of ash. The aqueous solution of an alcoholic extract is coloured green with ferric chloride, precipitated yellow with plumbic acetate and strong alkalies, and is unaffected by tannin, alkaloidal reagents and gelatine. Evaporated portions were crystalline, and dissolved with evolution of gas in strong sulphuric acid with an orange colour, turning brown when heated. The solution when saturated with ether and allowed to stand with an excess of the ether, threw out a number of crystals on the sides of the vessel. These crystals appeared white in the presence of the mother liquor, but when removed by filtration and washed, they had a slight yellow tinge. They were soluble in alcohol, but sparingly so in ether and water, and insoluble in benzol and chloroform. Alkalies and lime and baryta water dissolved them with a yellow colour, and a soluble compound was formed with magnesia. No colour was given with ferric salts unless the substance was previously neutralized, and then a green solution was produced. The crystals dissolved with a yellow colour in sulphuric acid discharged on dilution with water, and in nitric acid with a transient red brown colour. The crystals were acid in reaction and blackened steel when left in contact with it; they melted at 168° C. The mother liquor turned green and precipitated with ammonia, and showed evidence of a large amount of glucose by readily reducing Fehling's solution.

The leaves were powdered and given to animals to test their alleged poisonous properties. 5 to 10 grain doses were given to several chickens, 2 grams was given to a dog, and 5 grams, representing 20 leaves, was given to a fowl, with no results whatever in either case. The inspissated aqueous extract from 20 grams of the leaves was administered to a guinea pig without affecting its health. We must therefore conclude that the leaves are not poisonous, and could not have been the cause of the persistent vomiting in the case reported by the Bombay Chemical Analyser.

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ASCLEPIAS CURASSAVICA, *Linn.*

Fig.—*Bot. Reg.*, *t.* 81. Bastard Ipecacuanha (*Eng.*), Asclepiade de Curaçao (*Fr.*).

Hab.—West Indies. Introduced into India.

Vernacular.—Kurki (*Mar.*), Kakatundi (*Hind.*).

History, Uses, &c.—This perennial herb is indigenous to South America and the West Indies, where, in common with several other species of Asclepias, it is known as Milkweed, Silkweed or Wild Cotton. All of these plants have properties similar to Calotropis. The root of *A. curassavica* is employed in the West Indies as an emetic, and the milky juice which, when dry, forms a tough adhesive pellicle, is used to close wounds and excoriations of the skin. In Martinique the plant is called *Ipecacuanha blanc*, and in Guadaloupe *Herbe á Madame Boivin*, and the root is used in the same doses as Ipecacuanha. Introduced into India as a garden plant it has now run wild in many places, but, as far as we know, is not used medicinally by the natives.

Dr. Guimaraës (*Times and Gazette*, 1881, p. 661,) found it to act directly upon the organic muscular system, and especially upon the heart and blood vessels, causing great constriction of the latter and distension of the larger arteries. Secondarily it occasioned great dyspnœa, vomiting and diarrhœa.

Description.—Root-stock short, abruptly divided into numerous thin, pale yellowish-brown, and internally whitish rootlets. The bark is thin, and when fresh exudes a milky juice; taste bitter and somewhat acrid. A section of the root bark placed under the microscope shows from without inwards—1*st*, a suberous layer; 2*nd*, several rows of large cells containing conglomerate raphides, with starch and granular matter; 3*rd*, a vascular zone, two or three large dotted vessels being situated at the cambium end of each medullary ray, where it projects into the bark.

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The plant may be easily recognised by its oleander-like leaves, and red and orange flowers in terminal bunches. The follicles are like radish pods.

Chemical composition.—Dr. Gram (*Archiv. f. exp. Path. u. Pharm.* xix., 384,) has found the plant to contain an active principle of a glucosidal character, which he has named *asclepiadin*, and appears to consider a purer form of the asclepiadin of Harnack and the *asclepin* of Feneulle. This substance was yellowish, amorphous, and when freshly prepared very soluble in water; but either in solution or in a dry state it quickly decomposed, sugar being separated, and the residual compound becoming in proportion insoluble in water and inert. From an ethereal solution crystals gradually separated out, apparently identical with List's *asclepione*, and quite inactive physiologically.

The physiological action of the unaltered asclepiadin was found to closely resemble that of emetin, but in view of the instability of the compound, Dr. Gram doubts whether it can be advantageously introduced into medicine.

Asclepione, $C^{40}H^{54}O^{6}$, was discovered by C. List in the milk sap of *Asclepias syriaca*. (*Gmelin Handb.* 17, 368.) Feneulle separated a resinous substance and a bitter principle (asclepin) from *Asclepias Vincetoxicum*. (*J. Pharm.* 11, 305.)

CALOTROPIS GIGANTEA, *R. Br.*

Fig.—*Wight Ill.*, *t.* 155; *Griff. Ic. Pl. As.*, *t.* 397, 398. Gigantic Swallowwort (*Eng.*), Arbre a soie (*Fr.*).

Hab.—Throughout India, Malay Islands, S. China.

CALOTROPIS PROCERA, *R. Br.*

Fig.—*Wight Ic.*, *t.* 1278; *Bentl. and Trim.*, *t.* 176

Hab.—W. and Central India, Ava, Persia to Africa. The root bark, milky juice and flowers.

Vernacular.—Ak, Madár (*Hind.*), Akanda (*Beng.*), Akra, Rui (*Mar.*), Erukku, Yercum (*Tam.*), Jilledu-chettu, Mandáramu (*Tel.*), Akado (*Guz.*), Ekke-, Yakke-gida (*Can.*)

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History, Uses, &c.—Calotropis is mentioned by the earliest Hindu writers, the leaves, *arkapattra*, *arkaparna*, "sun leaf" or "lightning leaf," so called from their cuneiform shape, were used in Vedic times in Sun-worship. According to the Shatapatha Bráhmana every part of the human form was supposed to be represented in the different parts of the plant, nevertheless it would appear to have been dreaded (*Panchatantra* i. 57), and was supposed to blind those who approached it. (*Mahabhárata* i. 716.) These myths appear to have arisen from the Hindus attributing to the plant the properties possessed by lightning and the sun's rays. (*De Gubernatis.*) As a medicine Calotropis is noticed by Susruta and other medical writers, some of whom mention two varieties, *arka*, and *alarka*, "a white-flowered kind." Calotropis bears many synonyms in Sanskrit, such as Rudra, Aditya, Suryapattra and Mandára, from the last of which is derived the vernacular form Madár.

In Western India, and probably elsewhere, there is a curious superstition that a leaf of the Akra (Arka) fetched from the tree with certain ceremonies is of use in tedious labour. The friends of the woman take a packet of betelnut and leaf and a piece of money, and proceed to the plant, which they address in the most respectful manner, placing the betel packet at its root and asking for the loan of one of its leaves, which they promise to return shortly. They then take away a leaf and place it upon the head of the parturient woman, where it remains for a short time, and is afterwards returned to the plant. This practice appears to be connected with the worship of the Maruts or winds, demigods subject to Rudra, to whom these plants are sacred. The Maruts are worshipped on Saturday with a garland of the flowers. The twigs are used as *samidhas*, and the leaves are used by some in the *shati puja* to propitiate the goddess of parturition. Calotropis is also the *kul* or *Arbor generationis* of the Bhandári caste, whose business it is to tend the palm gardens and extract the juice of the trees. Another custom general amongst all castes of Hindus is that a man who has lost three wives must make his fourth marriage with the Arka tree, after which he may take a fourth human wife. The object of this seems to be to transfer the man's ill-luck to the plant. The ancient Arab tribes appear to have held superstitious notions about Calotropis, probably connected with Sun-worship. *C. procera* was first described by Abu Hanifeh *circa* 270 A.H. in his Book of Plants. From the Kámus and the Táj-el-arūs we learn that Ushar was used by the Arabs in the Time of Ignorance along with سلع (salaa) in the practice called تسليع (tasliaa) which was observed in time of drought or barrenness of the earth. It consisted in tying the dried plants to the tails of wild bulls, setting fire to them, and driving the animals down from the mountains, seeking to obtain rain by the flame of fire, which was likened to the gleaming of lightning. The *Salaa* from Abu Hanifeh's description appears to have been a kind of Cuscuta. According to the Burhan, عشر (ushr) is a Persian name for all plants having a milky juice, and especially for the plant known in Hindustan as Ák. It would therefore seem that Ushar is not an Arabic word, as generally stated in the Dictionaries, but of Arian origin, and perhaps connected with the Sanskrit verb उष to burn. The wood is considered to make the best charcoal for the preparation of gunpowder, and Ushar silk خرفع is used to stuff cushions by the Arabs, and also to make tinder (makhad), called by the Tartars yálish. Ibn Sina notices Ushar, and an exudation obtained from it called Sakar-el-ushar; he also mentions a superstitious notion that it is fatal to sit under the tree. The author of the Minháj describes Sakar-el-ushar as a gum which exudes from the inflorescence of the plant and gradually hardens. (He remarks that people say that it is a dew which falls upon the plant and concretes like manna.) Some medical writers confound it with Sakar-el-tighál. Abu Hanifeh and the author of the Obáb describe it as an exudation from the flowering parts of the plant. The best authorities describe its properties as similar to those of the juice of the plant, it would therefore seem to be nothing more than an exudation of the juices of the plant which naturally contain some sugar. Calotropis is not mentioned by Greek or Roman writers, but some Mahometans give *Hejakiyus* as its

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Yunani name; this appears to be a corruption of the word *ἡγιάθεος*, "most holy," or "under divine protection," and was probably applied to the plant by some of the Syrian physicians who instructed the Arabs in Greek medicine. The modern Persians call *C. procera* Khark and Darakht-i-zahrnàk, or "poison tree."

By Hindu physicians the root bark is said to promote the secretions and to be useful in skin diseases, enlargements of the abdominal viscera, intestinal worms, cough, ascites, anasarca, &c. The milky juice is regarded as a drastic purgative, and caustic, and is generally used as such in combination with the milky juice of *Euphorbia neriifolia*. The flowers are considered digestive, stomachic, tonic and useful in cough, asthma, catarrh and loss of appetite. The leaves mixed with rock salt are roasted within closed vessels, so that the fumes may not escape. The ashes thus produced are given with whey in ascites and enlargements of the abdominal viscera. The following inhalation is prescribed for cough: Soak the powdered root bark of Arka in its own milky juice and dry. Bougies are then prepared from the powder, and their fumes inhaled. The root bark, reduced to a paste with sour conjee (rice vinegar), is applied to elephantiasis of the legs and scrotum. The milky juices of *C. gigantea* and *Euphorbia neriifolia* are made into tents with the powdered wood of *Berberis asiatica*, for introduction into sinuses and *fistulæ in ano*. The milky juice is applied to carious teeth for relief of pain." An oily preparation (*Arka taila*) made by boiling together 8 parts Sesamum oil, 16 parts Calotropis juice, and one part turmeric, is said to be useful in eczema and other eruptive skin diseases. In the Concan the milk with powdered mustard is applied as a *lep* to rheumatic swellings, the flowering tops pounded and boiled with molasses, are given in doses of about one drachm every morning as a remedy for asthma. In want of virility the following prescription is in vogue: Take 125 of the flowers, dry and powder, then mix with one tolá each of cloves, nutmegs, mace and pellitory root, and make into pills of six massas each. One pill may be taken daily dissolved in milk.

The author of the *Makhzan-el-adwiya* says there are three varieties of Calotropis—*1st*, a large kind with white flowers, large leaves, and much milky juice, it is found near towns and the habitations of man; *2nd*, a smaller kind with smaller leaves, the flowers white externally but lilac within; *3rd*, a still smaller plant, with pale yellowish green flowers. The second and third kinds grow in sandy deserts. The properties of all three are similar, but the first kind is to be preferred, as it produces the largest quantity of milk. The juice is described as caustic, a purge for phlegm, depilatory, and the most acrid of all milky juices. Tanners use it to remove the hair from skins. Medicinally, it is useful in ringworm of the scalp, and to destroy piles; mixed with honey it may be applied to aphthæ of the mouth; a piece of cotton dipped in it may be inserted into a hollow tooth to relieve the pain. Hakím Mír Abdul Hamíd, in his commentary upon the Tuhfat, strongly recommends Calotropis in leprosy, hepatic and splenic enlargements, dropsy and worms. A peculiar method of administration is to steep different kinds of grain in the milk and then administer them. The milk itself is a favourite application to painful joints, swellings, &c., the fresh leaves also, slightly roasted, are used for the same purpose. Oil in which the leaves have been boiled is applied to paralysed parts; a powder of the dried leaves is dusted upon wounds to destroy excessive granulation and promote healthy action.

All parts of the plant are considered to have valuable alterative properties when taken in small doses.

C. procera was observed in Egypt by Prosper Alpinus (A. D. 1580—84), and upon his return to Italy was badly figured, and some account given of its medicinal properties. (*De plantis Ægypti*, Venet. 1592, cap. 25.) A much more correct figure was published in 1638 by his commentator Vesling. Rheede (*Hort. Mal.* ii., t. 31) figures a white-flowered Calotropis (*Bel-ericu*) and a lilac (*Ericu*), and Rumphius (*Hort. Amb.* vii., t. 14, f. 1) figures *C. gigantea* under the name of *Madorous*. Roxburgh (II., 30,) gives a botanical description of *C. gigantea* under the name of *Asclepias gigantea*, and

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mentions the medicinal uses to which it is applied by the natives of India. Ainslie, in his *Materia Medica of Hindustan* (1813), mentions two kinds of Calotropis, and in the *Materia Indica* he says, "Both plants in their leaves and stalks contain much milky juice, which, when carefully dried, is considered as powerfully alterative and purgative, and has been long used as an efficacious remedy in the Koostum (lepra Arabum) of the Tamools; the dose about the quarter of a pagoda weight in the day, and continued for some weeks. The root of the *Yercum* has a bitter and somewhat acrid, or rather warm taste; it is occasionally given in infusion as a stimulant in low fever. Of the other variety, the *Vullerkoo*, the bark is warmish, and when powdered and mixed with a certain portion of margosa oil, is used as an external application in rheumatic affections. In the higher provinces of Bengal the Arka is supposed to have antispasmodic qualities. Mr. Robinson has written a paper on elephantiasis, which may be seen in Vol. X. of the *Journ. of the Medico-Chirurgical Society*, extolling the madar root (Yercum vayr) as most efficacious in that disease, as also in venereal affections. In elephantiasis he gave it in conjunction with calomel and antimonial powder, in a pill, consisting of half a grain of calomel, three of antimonial powder, and from six to ten of the bark of the madar root, every eight hours. Mr. Playfair has also written a paper on the same root which may be seen in Vol. I. of the *Edin. Med. Chirurg. Trans.*, p. 414, wherein he speaks in praise of the alterative, stimulant, and deobstruent virtues of the bark, or rather rind below the outer crust of the root, reduced to fine powder, in cases of syphilis, lepra, hectic fever, &c., dose from grs. 3 to 10 or 12, three times in the day, gradually increasing it. Messrs. Robertson, Playfair, and others seem chiefly to dwell on the virtues of the rind or bark of the root; but I must observe, that in Lower India, where I was for many years, I found the simple dried milky juice considered as infinitely more efficacious; and later communications from the East confirm me in this opinion." (*Op. cit.* I., p. 487.)

The emetic properties of Calotropis were brought to the notice of the profession in Europe by Dr. Duncan in 1829 (*Edin. Med. and Surg. Journ.*, XXXII., p. 65), and they are noticed in the *Bengal Dispensatory,* where the drug is recommended as a substitute for Ipecacuanha. Since the publication of that work abundant testimony in its favour has been collected, a summary of which will be found in the *Pharmacopœia of India.* Duncan (1829) made a chemical examination of the root bark, the activity of which he referred to an extractive matter which he termed *Mudarine.* A kind of gutta-percha was obtained from the juice of this plant by Dr. Riddell, Superintendent Surgeon H. H. the Nizam's Army, in 1851. (*Journ. Agri-Hort. Soc. of India*, Vol. VIII.) In 1853 it was examined by Prof. Redwood, who found it to possess many properties in common with the gutta-percha of commerce. No further trial of this substance appears to have been made during the last 37 years.

Modern physiological research has shown that the juice applied to the skin acts as an irritant, the practice of applying it with salt to bruises and sprains to remove pain is therefore rational; also the application of the fresh bark in chronic rheumatism. Given internally in small doses the drug stimulates the capillaries and acts powerfully upon the skin, it is therefore likely to be useful in elephantiasis and leprosy. (*Casanora.*) The benefit derived from the administration of the flowers in asthma is probably due to their nauseant action. In large doses Calotropis causes vomiting and purging, acting as an irritant emeto-cathartic.

Description.—The root barks of *C. gigantea* and *C. procera* are similar in appearance, and occur in short quilled pieces ⅛ to ⅕ of an inch thick. The outer surface is yellowish-grey, soft and corky, fissured longitudinally, and can be easily separated from the middle cortical layer, which is white, friable, and traversed by narrow brown liber rays. The taste is mucilaginous, bitter and acrid, and the odour peculiar.

Microscopic structure.—In both kinds of root bark the suber consists of large thin-walled cells, generally polyhedral. The parenchyme of the middle cortical layer is loaded with starch and contains some sclerenchymatous cells. The cells of the medullary rays also contain starch and crystals of oxalate of lime. In the middle layer are numerous laticiferous vessels, the contents of which are of a brown colour.

Chemical composition.—The authors of the *Pharmacographia* state, that by following the process of Duncan, 200 grammes of the powdered bark of *C. gigantea* yielded nothing like his mudarine, but 2·4 grammes of an acrid resin soluble in ether and alcohol. The latter solution reddens litmus; the former on evaporation yields the resin as an almost colourless mass. When the aqueous liquid is separated from the crude resin, and much absolute alcohol added, an abundant precipitate of mucilage is obtained, and the liquid now contains a bitter principle, which after due concentration may be separated by means of tannic acid. Similar results were obtained by exhausting the bark of *C. procera* with dilute alcohol. The tannic compound of the bitter principle was mixed with carbonate of lead, dried, and boiled with spirit of wine. This after evaporation furnished an amorphous, very bitter mass, not soluble in water, but readily so in absolute alcohol. The solution is not precipitated by an alcoholic solution of acetate of lead. By purifying the bitter principle with chloroform or ether, it is at last obtained colourless. This bitter matter is probably the active principle of Calotropis; they ascertained by means of the usual tests that no alkaloid occurs in the drug. (*Op. cit.*, 2nd Ed., p. 426.) Drs. Warden and Waddell (1881) commenced an examination of Madár root bark in Calcutta, and obtained a substance crystallizing in nodular masses, which they thought would prove to be the *Asclepione* of List, but subsequently (1885), upon Warden continuing the investigation of the drug in the Chemical Laboratory of the Gesundheits Amt, Berlin, he found the substance supposed to be asclepione to have a composition corresponding with the formula $C^{17}H^{28}O$, whereas List's asclepione is represented by the formula $C^{20}H^{34}O^{3}$.

The white cauliflower masses of crystals obtained in Berlin were found to agree closely, as regards their melting point and behaviour with solvents, with a substance called *Alban*, obtained by Payen from gutta-percha (*Jahresbericht über die Fortsch. der Chimie*, 1852, p. 643), they were accordingly named *Madar-alban*. A yellow resin associated with madar-alban in the drug was found to agree, in behaviour with reagents, with the *Fluavil* found by Payen in gutta-percha, but as regards chemical composition the madar-alban and madar-fluavil differed from the alban and fluavil of gutta-percha. Dr. Warden also separated from the drug a *yellow bitter resin*, which is probably the active principle, and *Caoutchouc*.

He found the percentage of the various principles (the results being calculated on the bark containing 8·079 per cent. of water) to be—

Madar-alban	0·640
Madar-fluavil	2·471
Black acid resin	0·997
Caoutchouc free from M.-alban and M.-fluavil	0·855
Yellow bitter resin (active principle)	0·093

The fact that the sap of the Madár plant contains in addition to Caoutchouc two principles analogous to the alban and fluavil of gutta-percha is a point of some interest, as madár gutta-percha has been recommended as a substitute for the commercial article. For full particulars of the chemical examination, see *Pharm. Journ.*, Aug. 22nd, 1885.

Toxicology.—In India Calotropis juice is used for the purpose of infanticide by the castes among which that custom prevails, being placed in the mouth of newly-born female infants. It is also, like other emeto-cathartics, sometimes taken by women to procure abortion, and a few cases are on record of its having been used for suicidal purposes. Like other irritant vegetable juices it is not uncommonly used locally to produce abortion; usually a stick is armed with cotton impregnated with the juice and an attempt is made to introduce it into the os uteri, and leave it there until uterine contractions are induced, but this operation often fails from awkwardness on the part of the operator, and it is not unusual to find that the stick has been forced through the uterine walls. Another method of procedure is to select a twig of the plant, and after removing the leaves and making it as smooth as possible, to introduce it into the os uteri, or failing this to allow it to remain in contact with the parts. Pessaries also, containing the irritating juice of this and other plants, are placed in contact with the uterus to induce uterine action.

Commerce.—The flowers are to be found in the shops, but not the root bark, or leaves, no doubt from the circumstance that the plant is everywhere found wild and can be collected as required.

TYLOPHORA ASTHMATICA, *W. & A.*

Fig.—*Wight Ic., t.* 1277; *Bentl. and Trim., t.* 177; *Bot. Mag., t.* 1929.

Hab.—N. and E. Bengal, Assam to Burma, Deccan Peninsula, Ceylon. The root and leaves.

Vernacular.—Jangli-pikwán, Antamúl (*Hind.*), Antomúl (*Beng.*), Nach-churuppán, Nay-pálai, Pey-pálai (*Tam.*), Pitkari, Kharakí-rásna (*Mar.*), Verri-pala, Kukka-pála (*Tel.*), Valli-pála (*Mal.*), Adumuttada (*Can.*).

History, Uses, &c.—The medicinal properties of this plant appear to have been long known to the natives of those parts of India in which it occurs, but we can find no evidence of its ever having been an article of commerce, nor are we aware of its having been described in any of the standard Hindu or Mahometan works on Materia Medica; though it may perhaps be the Antri or Antra-páchaka of Sanskrit writers. The Hindi name Antomúl is derived from *ánt*, "the entrails," and *mul*, "a root." The expression *ánt girna* signifies "to suffer from dysenteric symptoms," literally "to void the intestines." Roxburgh says of it:—"On the coast of Coromandel, the roots of this plant have often been used as a substitute for Ipecacuanha. I have often prescribed it myself, and always found it answer as well as I could expect Ipecacuanha to do; I have also often had very favourable reports of its effects from others. It was a very useful medicine with our Europeans who where unfortunately prisoners with Hyder Ali during the war of 1780-83. In a pretty large dose it answered as an emetic; in smaller doses, often repeated, as a cathartic, and in both ways very effectually. Dr. Russell was informed by the Physician General at Madras (Dr. J. Anderson) that he had many years before known it used, both by the European and native troops, with great success in the dysentery which happened at that time to be epidemic in the camp. The store of Ipecacuanha had it seems been wholly expended, and Dr. Anderson finding the practice of the native doctors much more successful than his own, acknowledged with his usual candour that he was not ashamed to take instructions from them, which he pursued with good success; and collecting a quantity of the plant which they pointed out to him, he sent a large package of the roots to Madras. It is certainly an article of the Hindu Materia Medica highly deserving attention." (*Flora Indica* II., 34, 35.) Ainslie states that the Vytians prize the root for its expectorant and diaphoretic properties, and often prescribe it in infusion to the quantity of half a teacupful for the purpose of vomiting children who suffer much from phlegm. From possessing virtues somewhat similar to those of Ipecacuanha it has been found an extremely useful medicine in dysenteric complaints, and has, at times, been administered with the greatest success by the European practitioners of Lower India. (*Mat. Ind.* ii., 83.) More recently we have the testimony of O'Shaughnessy and Kirkpatrick to the value of the drug as an emetic, and as a substitute for Ipecacuanha in the treatment of dysentery, and the opinion of these physicians is confirmed by the reports furnished to the Committee who superintended the preparation of the *Pharmacopœia of India,* by Drs. Bidie, Oswald, Sheriff and others. Dr. J. Kirkpatrick (*Cat. of Mysore Drugs*) says:—"I have administered this medicine in at least a thousand cases, and found it most valuable. In dysentery, and as a simple emetic, it is in every way comparable with Ipecacuanha. The dose is from 20 to 30 grains, with half a grain or a grain of Tartar Emetic, if strong emesis is required. If the dysentery distinctly arise from intermittent disease, Quinine is conjoined. The form of the medicine I use is the powder of the dry leaf." Tylophora is also employed in Mauritius, where it is known as *Ipeca sauvage* or *Ipeca du pays*. In the *Indian Pharmacopœia* the leaves have been made official. In the Concan 1 to 2 tolás of the juice are given as an emetic; it is also dried and made into pills which are administered in dysentery. The pills are as large as the seed of *Phaseolus Mungo*; one pill is sufficient to produce one copious stool.

Description.—The leaves are opposite, entire, from 2 to 5 inches long, ¾ to 2½ inches broad, somewhat variable in outline, ovate or sub-rotund, usually cordate at the base, abruptly acuminate or almost mucronate, rather leathery, glabrous above, more or less downy beneath with soft simple hairs. The pedicel which is channelled is ½ to ¾ of an inch in length. In the dry state the leaves are rather thick and harsh, of a pale yellowish green; they have a not unpleasant herbaceous smell, with but very little taste. The root consists of a short, knotty, descending root stock, about ⅛ of an inch in thickness, emitting 2 to 3 aerial stems, and a considerable number of wiry roots. These roots are often 6 inches or more in length by ½ a line in diameter, and are very brittle. The whole drug is of a pale yellowish brown; it has no considerable odour, but a sweetish and subsequently acrid taste. In general appearance it is suggestive of valerian, but is somewhat stouter and larger.

Chemical composition.—A concentrated infusion of the leaves has a slightly acrid taste. It is abundantly precipitated by tannic acid, by neutral acetate of lead or caustic potash, and is turned greenish-black by perchloride of iron. Broughton of Ootacamund obtained from a large quantity of leaves a small amount of crystals—insufficient for analysis. Dissolved and injected into a small dog they occasioned purging and vomiting.

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A re-examination of the drug by one of us (D. H.) shows that both the leaves and root contain an alkaloid, *Tylophorine*, which is crystalline and forms a crystalline hydrochlorate. The solution of the alkaloid is precipitated by tannin, iodine in potassium iodide, potassio-mercuric iodide, perchloride of mercury, picric acid, volatile and fixed alkalies. The alkaloid in a free state is very soluble in ether and alcohol, but only partially in water. With sulphuric acid it dissolves with a reddish colour changing to green and indigo. With HNO^3 it dissolves with a purplish red colour. Fröhde's reagent gives a deep sap-green solution. Sulphuric acid and $K^2Cr^2O^7$ a dirty violet. The leaves afford 15 per cent. of mineral matter.

Tylophora fasciculata, *Ham. Wight Ic.*, *t.* 848, Bhuidodi (*Mar.*), is abundant in the Southern Concan, and is used as a poison for rats and other vermin. Lyon (*Med. Juris. for India*, p. 453) records the following case in which it proved fatal to man:—" A Mahometan family, consisting of six adults and a servant-boy, æt. about fourteen, were attacked soon after a meal with symptoms of poisoning, the servant-boy died in about two hours. The others were seen the next morning, when they complained of dryness of the throat, great thirst, and a feeling of soreness over the whole body. Their pupils were dilated, and pulse full and slow. They stated that soon after taking their mid-day meal on the previous day, they felt some tingling sensation in the mouth, followed by dryness of the tongue and throat and giddiness, and loss of power over the extremities. After this they became insensible. Three of them vomited and recovered consciousness at about 8 P. M.; the other three remained insensible till midnight. On *post-mortem* examination of the body of the boy, the following appearances were noted :—Face bloated, tongue and eyes slightly protruding, veins of the neck turgid. Lungs engorged; right side of the heart full, left empty. Slight congestion of the pia mater. A small patch of redness on the mucous membrane of the stomach. Accused in this case, it was stated, who was at enmity with the persons poisoned, asked a friend to recommend him something to kill rats with. The friend advised

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him to use *Bhui-dodi*. On this the accused, it was reported, obtained some *bhui-dodi* roots, and having reduced them to powder, mixed this with some flour, from which subsequently the food eaten at the meal referred to was prepared. Dr. G. G. Bopardikar of Pandharpur, who kindly supplied us with the plant, states that the leaves are generally used, pounded and mixed with flour to destroy rats. On enquiry the village Vaids informed him that the juice of the root is given with milk as a tonic, and that the leaves are pounded and used as an application to unhealthy ulcers and wounds to induce healthy granulation.

T. fasciculata is an erect or scarcely twining glabrous plant, with ovate, coriaceous leaves, decreasing in size upwards. The peduncles are erect, slender and flexuous, bearing at the flexures 2 to 3 few-flowered fascicles of minute flowers. The follicles are about 2 inches in length, ovoid-lanceolate and glabrous, with a very thick pericarp. The seeds are ¼ of an inch in length, broadly ovoid and quite flat. The root is thick, long and woody, from one to two inches in diameter at the crown. It is covered with a light brown corky bark, fissured longitudinally.

Chemical composition.—The leaves were very mucilaginous when treated with water, and even the alcoholic extract when evaporated to dryness made a thick solution with a large quantity of water. The latter solution was precipitated by alkaloidal reagents, and was most acrid to the taste. Shaken with ether a resinous body was removed, and then made alkaline with ammonia, which produced a slight precipitate, and again shaken with ether, a small quantity of an amorphous alkaloid was separated, which gave a yellowish brown colour with sulphuric acid, passing to a red. The leaves gave off slightly alkaline fumes when ignited, and left 12 per cent. of ash.

The roots reduced to fine powder were made into a tincture with strong spirit, and the evaporated tincture when treated with water left some resinous matter undissolved. The solu-

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tion shaken with ether yielded up some more resinous substance, which became encrusted with feathery crystals when the solvent had been dissipated. A larger quantity of alkaloid was present in the root than in the leaves, but it appeared to possess similar characters. It was amorphous, but formed a slightly crystalline hydrochloride. The damp crystals of the hydrochloride brought into contact with the fumes from a drop of nitric acid produced a bluish-green coloration. With sulphuric acid the alkaloid was first coloured reddish-brown, passing to carmine, and then to purple. It was precipitated from solution by the usual reagents.

The alcoholic extract was emetic and purgative. A quantity from 2 grams of the leaves mixed with bread and given to a chicken produced frequent and watery stools. The aqueous extract from the leaves, after removal of all that was soluble by means of alcohol, had no effect upon a guinea-pig.

DÆMIA EXTENSA, *Br.*

Fig.—*Wight Ic., t.* 596; *Jacq. Ic. Rar., t.* 54: *Hook. f. in Bot. Mag., t.* 5704.

Hab.—Throughout India. The leaves.

Vernacular.—Utian, Ságováni (*Hind.*), Veli-parutti, Uttamani (*Tam.*), Jittupaku, Dushtupu-chettu, Guruti-chettu (*Tel.*), Veli-paritti (*Mal.*), Utarani, Utarandi (*Mar.*), Kuntiga, Juttuve, Talaváranaballi (*Can.*), Nágala-dudheli (*Guz.*), Chhágal-báti (*Beng.*).

History, Uses, &c.—The Sanskrit name of this plant is Phala-kantaka, in allusion to its echinate follicles. The Hindi name Utran as well as the Marathi names are evidently derived from the Sanskrit *Ut-tara*, "ejecting or vomiting," and the Tamil name Dushtupu is also of Sanskrit origin, and signifies "having tainted flowers." The flowers and leaves have a fetid odour; they are used as an emetic and expectorant by the natives, especially in the diseases of children. The stems yield a fibre, and the leaves are eaten by goats. The plant

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was first fully described and figured by Jacquin; it is noticed by Ainslie under the name of *Cynanchum extensum*, who states that a decoction of the leaves is given to children as an anthelmintic, in doses not exceeding three table-spoonfuls, and that the juice is used as a remedy for asthma. Roxburgh describes the plant under the name of *Asclepias echinata*, but is silent about its medicinal properties. From the *Pharmacopœia of India* we learn on the authority of Dr. Oswald that it is used as an expectorant in the treatment of catarrhal affections, in ten grain doses, at the Pettah Hospital, Mysore. In the Southern Concan and Goa the juice of the leaves is applied to rheumatic swellings. Dr. B. Evers considers it a valuable emetic for children. He says:—"The leaves are washed and the juice expressed by rubbing them between the palms of the hands; the leaves of the dark *Tulsi* (*Ocimum sanctum*) are similarly treated, and then a mixture of the juices is given; this preparation is a stimulating emetic." Dr. P. S. Mootooswamy (*Ind. Med. Gaz.*, Feb., 1890,) notices the use of the juice in rheumatism in combination with ginger. He also states that it is used in the preparation of a purgative medicinal oil used in rheumatism, amenorrhœa and dysmenorrhœa, and that the root-bark is used as a purgative in rheumatic cases in doses of 1 to 2 drachms mixed with cow's milk.

Description.—The leaves are roundish, cordate, acuminate, pubescent, membranaceous, auricled at the base, glaucous beneath. They vary in size from one to two inches or more in diameter; the peduncles are long, slender and hoary. The plant has a disagreable mouse-like odour and a faintly bitter and somewhat nauseous taste; examined with a lens both the upper and under sides of the dry leaf present a green mossy surface, thickly studded with short white hairs. The flowers are dull white and drooping, the follicles have a curved beak, and are covered with soft bristles.

Chemical composition.—The leaves of *D. extensa*, like those of Tobacco and Adhatoda, evolve alkaline fumes when ignited, and like them contain an alkaloid. The alkaloid, which we

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have provisionally named *Dæmine,* is soluble in ether, alcohol and water, and shows no disposition to crystallize from these and other solvents. In contact with strong sulphuric acid it dissolves with a reddish-violet colour, gradually fading; with Fröhde's reagent it gives a yellowish brown coloration. It forms crystalline deliquescent salts very soluble in water, with a bitter taste. An alkaloid having similar properties was separated from a sample of the root. The ash from a sample of the dried and powdered leaves amounted to 15·33 per cent.

DREGEA VOLUBILIS, *Benth.*

Fig.—*Wight Ic., t.* 586; *Rheede Hort. Mal. ix., t.* 15, var. *Lacuna*; *Dcne. in Jacq. Voy. Bot.* 108, *t.* 114.

Hab.—Bengal, Assam, Deccan Peninsula, Ceylon. The root, herb, and fruit.

Vernacular.—Nakchikni (*Hind.*), Titakanga (*Beng.*), Hirandodi, Ambri (*Mar.*), Kodi-palai (*Tam.*), Dudhi-palla (*Te*[illegible]

History, Uses, &c.—This plant is not mentioned by Sanskrit writers; it is the *Watta Kakacodi* of Rheede, who states that the root is applied to snake-bites and given to women to cure headache after child-birth; and the *Kodie palay* of Ainslie (*Mat. Ind.* ii. 154), who remarks that "The root and tender stalks are supposed by the Vytians to possess virtues in dropsical cases; they sicken, and excite expectoration; though I could not obtain much information of a certain nature respecting them; it is to be presumed that they operate in a manner somewhat similar to the root of the *Asclepias curassavica.*" The leaves are much employed by the Hindus as an application to boils and abscesses to promote suppuration, and the brown mealy substance with which the follicles are covered is applied to the galls and sores of draught cattle. The plant is noticed in the secondary list of the *Pharmacopœia of India.* The variety *Lacuna* is preferred for medicinal use by the natives. Irvine (*Mat. Med., Patna*), says the plant is used in colds and eye-diseases to cause sneezing, whence the Hindi name Nakchikni. This property of the plant is also known in Madras, where the young shoots are cut and the exuding juice inserted into the nose. The follicles are frequently eaten by the natives in their curries, the process of boiling or cooking removes their bitterness and nauseating property.

Description.—A stout tall climber, branches often pustular, bark of the woody parts smooth, ash-coloured. Leaves 3 to 6 by 2 to 4 inches, rather coriaceous, base rounded or cordate; nerves 4 to 5 pairs; petiole 1 to 3 inches. Peduncles 1 to 3 inches, rather slender; umbels drooping, multifid, subglobose; pedicels ½ inch, slender, corolla ½ inch in diameter, cupular, lobes triangular. Stigma dome-shaped. Follicles horizontal, obtuse, about 3 to 4 inches long, and four in circumference at the base. In the variety *Lacuna* all parts of the plant, but especially the follicles, are covered with a brown mealy substance, which consists of moniliform hairs made up of cylindrical cells placed end to end. They can be well examined under the microscope with potash solution which colours them yellow.

Chemical composition.—The fresh follicles, freed from seeds and their comose appendages, were bruised in a mortar and the juice expressed. The juice was heated to boiling to coagulate albuminous matters and filtered, and the liquor, after evaporation to a small bulk, was treated with two volumes of spirit to remove mucilage and salts. After dissipating the spirit by a gentle heat, the acidulous solution had a bitterish taste, was free from tannic matters, and contained an abundance of glucose. It was shaken with ether, and the ethereal solution left a mass of light-coloured transparent scales, soluble in water with a peculiar bitterish-sweet taste and neutral or slightly acid reaction. This solution gave an abundant white precipitate with tannin, none with neutral plumbic acetate; and with alkaloidal reagents, such as potassio-mercuric iodide and iodine in potassium iodide, only if previously acidified. With strong aqueous alkali a precipitate, without colour,

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was obtained. With sulphuric acid the dried scales dissolved with a brown colour, passing through cherry-red to purple, and finally separated as a black powder. With nitric acid no colour was manifested in the cold. Boiling with diluted acid destroyed the bitterness of the principle, with the formation of an insoluble brown substance, such as would attend the decomposition of a glucoside. We consider this glucoside to be the active principle of the fruits, and propose to name it *Dregein.*

HEMIDESMUS INDICUS, *Br.*

Fig.—*Wight Ic., t.* 594 ; *Rheede Hort. Mal. x., t.* 34 ; *Bentl. and Trim., t.* 174. Indian Sarsaparilla (*Eng.*), Salsepareille de l'Inde (*Fr.*).

Hab.—Northern, Western, and Southern India. The roots.

Vernacular.—Anantamul (*Hind., Beng.*), Upersára, Dudha sáli (*Mar.*), Nannári (*Tam.*), Sugandhi-pála (*Tel.*), Sogadé, Karibanta (*Can.*), Upalsári (*Guz.*).

History, Uses, &c.—Dutt. (*Hind. Mat. Med.*, p. 195) states that in Hindu medicine *H. indicus* and *Ichnocarpus frutescens* (see Apocynaceæ) are both called Sáriva, and are described under the name of Sárivadvaya, or the two Sárivas. They are often used together, and are considered to have similar properties. When however Sáriva is used in the singular number, it is the usual practise to interpret it as meaning *I. frutescens.* Other Sanskrit names for these plants are Nága-jihva, "snake's tongue," and Gopa-kanga, "cowherd's daughter." *H. indicus* is distinguished as Utpala-sáriva. The Hindus consider them to be demulcent, alterative and tonic, and prescribe them in dyspepsia, skin diseases, syphilis, fever and dysentery; they are generally combined with bitters and aromatics. Under the name of Nannári, Hemidesmus is much used in Southern India, but in the northern part of the Bombay Presidency, though a common plant, it is seldom obtainable in the bazaars, imported sarsaparilla being offered when inquiries are made for it. In the more southern parts of the Concan

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the milky juice is dropped into inflamed eyes; it causes copious lachrymation, and afterwards a sensation of coolness in the part. The root is tied up in plantain leaves and roasted in hot ashes; it is then beaten into a mass with cumin and sugar and administered with *ghi* as a remedy in heat or inflammation of the urinary passages. As a *lep* the root is applied to swellings. It is used in Madras in mixtures for purifying the blood as ordinary Sarsaparilla is in other countries, and it is an adjunct in chutneys and pickles simply as a flavouring agent.

Recent Mahometan physicians under the name of *ushbah* describe several kinds of sarsaparilla, of which they say the Western or Andalusian is the best. Another kind is described by the author of the *Makhzan-el-adwiya* as having flowers like yellow jasmine; this may possibly be Hemidesmus. The authors of the *Pharmacographia* remark that there is an Indian root figured as *Palo de Culebra* by Acosta (*Tractado de las Drogas de las Indias orientales*, 1578, *cap. LV.*) which is astonishingly like the drug in question. He describes it, moreover, as having a sweet smell of melilot. The plant he says is called in Canarese *Duda-sáli*. The figure is reproduced in Antoine Colin's translation, but not in that of Clusius. This plant must be the true Hemidesmus, as *Dudha-sáli* is a name it is known by in the Concan. In Goa at the present day Hemidesmus root is to be found in all the shops; it is known to the Portuguese as *Uperçao*, an evident corruption of the Maratha name. Ashburner in 1831 was the first to call the attention of the profession in Europe to its medicinal value, and in 1864 it was made official in the British Pharmacopœia. In India O'Shaughnessy found its diuretic action to be very remarkable; two ounces infused in a pint of water and allowed to cool was the quantity usually employed daily, and by such doses the discharge of urine was generally trebled or quadrupled. It also acted as a diaphoretic and tonic, and so increased the appetite that it became a most popular remedy in his hospital, the patients themselves entreating its administration and continuance. (*O'Shaugh-*

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nessy, *Dispensary*, p. 456, *Beng. Pharm.*, p. 279—301). In 1868, Hemidesmus was made official in the *Pharmacopœia of India.* Lastly, in 1874, it was described by Flückiger and Hanbury in the *Pharmacographia.*

Description.—The drug is found in commerce in India in the form of little bundles, which consist of the entire roots of one or more plants, often several feet long, tied up with a portion of the stem.

The root is cylindrical, tortuous, from $\frac{2}{10}$ to $\frac{7}{10}$ of an inch in diameter, seldom branched. The bark is transversely cracked and fissured longitudinally, of a dark brown colour, sometimes with a slight violet hue when viewed in a strong light; the wood is yellow and porous. The fresh or freshly-dried root has a fine odour of tonka bean or melilot, and a sweet but slightly acrid taste.

Microscopic structure.—According to Flückiger and Hanbury, all the proper cortical tissue shows a uniform parenchyme, not distinctly separated into liber, medullary rays and mesophlœum. On making a longitudinal section, however, one can observe some elongated laticiferous vessels filled with the colourless concrete milky juice. In a transverse section, they are seen to be irregularly scattered through the bark, chiefly in its inner layers, yet even here in not very considerable number. They are frequently 30 mkm. in diameter and not branched.

The wood is traversed by small medullary rays, which are obvious only in the longitudinal section. The parenchymatous tissue of the root is loaded with large ovoid starch granules. Tannic matters do not occur to any considerable amount except in the outermost suberous layer.

Chemical composition.—The aroma and taste of the drug is due to the presence of coumarin (see Vol. I., p. 406), which can be obtained in part by boiling the root with water. Crystals of coumarin can be prepared from the residue after distillation by drying and extracting with alcohol. This is no doubt the substance obtained by Garden in 1837, and called smilasperic acid, and subsequently by Scott in 1843, who described it as a crystalline stearopten.

Commerce.—In Southern India and Bengal the root is met with in commerce, but is often so old as to be quite worthless. In Bombay arrangements have to be made for its collection, which costs Re. ¼ per lb., owing to the difficulty of digging the roots in stony ground.

COSMOSTIGMA RACEMOSUM, *Wight.*

Fig.—*Wight Ic., t.* 591, 1270; *Rheede Hort. Mal. vii. t.* 32.

Hab.—Sylhet, Chittagong, W. India, Ceylon. The root and leaves.

Vernacular.—Ghárahuvvu (*Can.*), Shendvel, Shendori, Márvel, Márvivel (*Mar.*), Vattu-valli (*Mal.*), Ghárphúl (*Goa.*).

History, Uses, &c.—This large woody climber running over high trees, has a medicinal reputation on the Western Coast, where its leaves are used to cure ulcerous sores Ghára (घाड) and the root bark is administered internally in Vataka (वटक), a disease in which white lumps of undigested food are passed. Rheede is the only European writer who notices its medicinal properties; he states it is called *Torique* by the Portuguese and *Pensbout* by the Dutch; after mentioning the use of the leaves, he remarks: "Cortex cum Sandalo et muliebri lacte in formam noduli adhibitus, præstantissimum *Causonis* remedium est." The disease he alludes to is the καυσος of the Greek physicians, and is described by Paracelsus as characterised by pungent heat internally, great heat of breath, desire of cold air, dryness of the tongue, lips, and skin, coldness of the extremities, the urine loaded with bile, watchfulness, and a quick, small and weak pulse. In modern medicine we should describe it as dyspepsia accompanied by a febrile condition and absence of bile in the stools. We have tried the root bark of this plant in such cases, given in five grain doses three times a day, and have found it to be a most efficient cholagogue; it had no purgative effect, but restored the natu-

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ral colour of the stools after the usual remedies (mineral acids, podophyllin, euonymin, &c.,) had been abandoned in despair. The flowers of this plant are sweet and are eaten by the natives. A biscuit was made with the powder of two ounces of the root and given to a dog without any ill effects.

Description.—Leaves large, rather coriaceous, smooth, ovate-cordate, acuminate, but sometimes rounded with an obtuse tip, readily distinguished by a group of small, brown, dusty, prominent glands at the junction of the petiole with the leaf. Roots from ¼ to 1 inch in diameter, externally light brown and scabrous; fracture starchy and friable, a transverse section shows them to be composed of a central woody column and a very thick greyish-white cortex. In the circumference, and sparingly scattered through the root, light yellow brown hard cells are seen. The root has no taste, and a faint Ipecacuanha-like odour, which is more marked in the seeds. The latter are contained in a large, smooth, green follicle.

Chemical composition.—An ether extract of the powdered root contained some free, crystalline fatty acids, soluble in cold rectified spirit and aqueous alkalies. Petroleum ether dissolved the fatty acids from the extract, leaving a small quantity of an acid resin. An alcoholic extract, in addition to a resin, contained a sugar, and a substance affording the reactions of an alkaloid. The resin is decomposed by boiling with dilute acids, and gives a purplish colour with strong sulphuric acid. It is glucosidal and is related to jalapin. An aqueous extract contained gum and a carbohydrate having the properties of dextrin. The root was devoid of astringency. The powder mixed with milk of lime gave off ammonia. The larger roots left 3·16 per cent., the smaller ones 5·86 per cent. of inorganic matter on incineration.

GYMNEMA SYLVESTRE, *Br.*

Fig.—*Wight Ic., t.* 349.

Hab.—Banda, Deccan Peninsula. The leaves and root.

Vernacular.—Mera-singi (*Hind.*, *Beng.*), Kavali, Vákhandi (*Mar.*), Siru-kurinja (*Tam.*), Sanna gerse (*Can.*).

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History, Uses, &c.—This shrubby climbing plant is called Meshasringi, "ram's horn," in Sanskrit, but it is not mentioned in the Raja Nirghanta. It is considered to be the Meshasringi of Madanpal's Nighanta and of the Marathi and Guzerathi Nighantas, which are little more than translations of that work. It bears the following synonyms—Mesha vishánika, Meshavalli, Sarpa-darushtrika, Anyáda, Kshina-vartta, Vrikshikáli and Vishánika, and is described as having a pungent taste and the properties of an astringent and bitter stomachic; useful in cough, biliousness, boils, sore eyes, &c.

It is also in repute amongst the Hindus as a remedy for snake bite, the powdered root being applied to the part bitten, and a decoction administered internally. Its use for this purpose is well known to the natives of the Concan, and as appears from Ainslie (*Mat. Ind.* II., 390), also to the natives of Southern India. The root is also said to have virtues similar to Ipecacuanha. Roxburgh describes the plant under the name of *Asclepias geminata*, and remarks that the small yellow flowers, with the globular apex of the white common stigma, projecting in the centre, look like fine pearls set in gold. He says nothing of its medicinal properties. *G. sylvestre* is said to be the *binnuge* of the Cingalese. A curious circumstance connected with this plant was first noticed by Mr. Edgeworth, namely, that if chewed it destroys the power of the tongue to appreciate the taste of sugar and all saccharine substances. This property of the leaves has been recently (1887) tested carefully by Mr. D. Hooper, who says:—" After chewing one or two leaves it was proved undoubtedly that sugar had no taste immediately afterwards. Sugar in combination with other compounds in dietetic articles is plainly destroyed as to its taste after using these leaves. In ginger bread, for instance, the pungency of the ginger is alone detected, the rest is tasteless meal; in a sweet orange the taste of the sugar is so suppressed and that of the citric acid consequently developed, that in eating it resembles a lime in sourness. Among the several kinds of foods, drugs and beverages which affect the palate, *Gymnema* does not pretend to render them all tasteless, it does not affect pungent saline things, astringents and acids. It is limited to apparently two diverse substances—sweets and bitters. It has been noted that sugar taken after the leaf tastes like sand, so I have found that sulphate of quinine taken after a good dose of the leaf tastes like so much chalk. I am not going to propose its use in the administration of nauseous drugs, until the medical properties of the *Gymnema* have been more studied, otherwise the quantity of the vehicle taken may prove to counteract the effect of the medicines. The experience of several friends as well as my own is that the effect does not last for twenty-four hours as stated, but for only one or two hours, after that time the tongue resumes its appreciation of all that is sweet or bitter." In the Concan the dried and powdered leaf is used as an errhine, and the fresh leaves crushed and mixed with water, as a cooling bath for children in the hot weather.

Description.—*G. sylvestre* is a shrubby climbing plant. The leaves are from 4 to 5 inches long, from ovate-lanceolate to obovate; upper surface dark green, shining, under surface pale green, shortly pubescent; venation transverse and reticulate with a marginal vein; taste saltish and acrid. The root is about the size of the little finger or less, not unlike *Hemidesmus*; it has a tough wood, and when fresh a soft spongy bark, which is reddish brown and fissured longitudinally, but loses much bulk in drying, and becomes loose and transversely fissured; the taste is acrid and saltish; the whole plant abounds in milky juice.

Microscopic structure.—The woody portion of the root has a radiate structure, and is traversed by large vessels; the extension of the medullary rays into the bark is distinct; the latter is made up of a thin-walled parenchyma, the cells of which contain much starch and tolerably numerous crystalline concretions. There are many laticiferous vessels, especially towards the inner part. The epidermis consists of several layers of flattened cells of a deep reddish brown colour.

Chemical composition.—The powdered leaves were submitted to the action of various solvents, and by this means it was ascertained, that the peculiar property of *Gymnema* leaves was dissolved out by alcohol, and, as it occurred in the aqueous extract of the residue, it was therefore soluble in water. As benzine and ether took from the leaves certain principles of the same appearance and weight, it was conceived that nothing would be gained by using both solvents; the preliminary extraction was therefore made with rectified spirit. The ether extract consisted of chlorophyll and two resins separated by their solubility in alcohol. The resin insoluble in alcohol formed the larger portion; it was soluble in chloroform, bisulphide of carbon and benzine. It was elastic and tenacious, decomposed by warming with nitric acid, the product being precipitated with water; only partially saponified with caustic potash. Sulphuric acid dissolved it in the cold, giving a green solution. It seemed to consist principally of a neutral resin. The resin soluble in spirit was readily saponified with soda, and gave a permanent bluish green colour with sulphuric acid; like the former resin it was of an acrid nature, and left a tingling sensation in the throat. The alcoholic solution of the leaves was almost entirely soluble in water; in fact, by treating the leaves separately by alcohol and water, 36·37 per cent. of organic matter was extracted, by treating the drug with water alone 36 per cent. was removed. By direct experiment it was found that in the former extract 0·74 per cent. was an acrid resin similar to those found in the ether extract. The aqueous solution of the substances soluble in alcohol had a decidedly acid reaction, it gave no colouration with ferric chloride, showing absence of tannin. It was deepened in colour with alkalies, but gave a bulky precipitate with sulphuric, nitric, hydrochloric and acetic acid. It reduced Fehling's solution on boiling, and gave a cloudiness with Nessler, a precipitate with lead acetate, but none with tannin or picric acid. The precipitate caused by sulphuric acid was collected on a filter and washed till it ceased to give a cloudiness with barium chloride. It yielded a greenish powder, insoluble in water, but soluble in alcohol, ether, benzine and chloroform. With potash, soda and ammonia it afforded fine red solutions with orange coloured froth, but they were both precipitated on the addition of the mineral acids. It dissolved in concentrated sulphuric and nitric acids with intense red colour, but in both mixtures it was destroyed and precipitated by water. It fused at about 60° C. into a blackish brittle mass. Heated in a test tube it gave off fumes of creasote, but no crystals were obtained in a subliming apparatus. Gently ignited it burnt with a bright flame, leaving no ash. It was thrown down as a bulky grey mass by acetate of lead, the lead salt decomposed by sulphuretted hydrogen in spirit left the substance in the reddish evaporated filtrate from the lead sulphide. The body just described has the characteristics of an organic acid related in some particulars to glycyrrhizic acid, but having some distinctly peculiar reactions and possessing the antisaccharine property ascribed to the leaves, I propose to call it *Gymnemic Acid*. Gymnemic acid forms more than six per cent. of the constituents of Gymnema leaves in combination with a base which is inorganic. It is a monatomic acid, having the formula, $C^{32} H^{55} O^{12}$, and requiring theoretically 14·63 per cent. of metallic silver and 15·20 per cent. of PbO for its silver and lead salts. It forms insoluble salts with alkaloids, and this accounts for its masking the taste of quinine. The acid is a glucoside. After boiling for about an hour with dilute hydrochloric acid, a dark resinous mass, devoid of the peculiar property of the leaves, remains, and the liquor contains a body which readily reduces Fehling's solution and crystallizes when evaporated. Another organic acid was present in the lead acetate precipitate, which was identified as tartaric acid. The filtrate from the insoluble lead compounds was treated with sulphuretted hydrogen gas, and the clear liquor after evaporation was examined for sugar. Glucose was detected in some quantity by its immediate and abundant reduction of Fehling's solution; the sugar examined in a polariscope had a left-handed rotation. Chloroform agitated with an alkaline solution of the leaf left a crystalline residue of a brownish colour; it had a bitter taste, and acted as a sialagogue. With the ordinary alkaloidal reagents it afforded coloured precipitates, but was a neutral principle.

A solution of one per cent. hydrochloric acid was employed to remove the oxalate of calcium; a microscopical examination of the powdered leaves showed a fair sprinkling of the conglomerate crystals or raphides so well known to exist in Rhubarb. The dilution of the acid menstruum rendered this process very tedious, so a stronger acid was used, and the marc washed with it until ammonia produced no cloudiness. The collected liquors were allowed to deposit, the sediment was then collected on a filter, dried and weighed, then incinerated and weighed again. The calcium carbonate was calculated into oxalate, and the difference between this and the first weighing was reckoned as pararabin, No oxalic acid was found in a free state. The ash of *Gymnema sylvestre* is very high, a fact in accordance with the amount of lime salts it contains. Gentle ignition of the air-dried leaves left as much as 11·65 per cent. and about one-half of this was calcium carbonate. One hundred parts contained:

15·41 soluble in water.
78·71 soluble in acid.
5·88 sand and siliceous residue.

The following is a tabulated analysis of the sun-dried and powdered leaves;—

Ether extract (chlorophyll and resins)		5·51
Alcoholic extract (gymnemic acid, tartaric acid, glucose, neutral bitter principle, resin, &c.)		19·50
Aqueous extract (gum 1·45 per cent., glucose, carbohydrate and extractive)		16·87
Alkaline extract, by difference (albuminous and coloring matters)		8·15
Acid solution	Calcium Oxalate	7·44
	Pararabin	7·62
Ash (balance of)		5·69
Cellulose		27·86
Moisture		6·04
		100·0

—(*Hooper in Pharm. Journ.*, April, 1887, and *Chem. Nws*, April, 1889.)

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CEROPEGIA BULBOSA, *Roxb.*

Fig.—*Roxb. Cor. Pl.* i., 11, *t.* 7; *Wight Ic.*, *t.* 845; *Hook. Bot. Misc.* ii., 99; and *Suppl. t.* 2.

Hab.—From Western India, the Punjab and Upper Gangetic plain as far east as Allahabad, southwards to Travancore.

Vernacular.—Mánchi, Manda (*Tel.*, *Tam.*), Gálot (*Punj.*), Khapparkadu, Gáyala (*Mar.*).

History, Uses, &c.—Several forms of this variable plant are described in the *Flora of British India* with leaves from nearly orbicular to linear-lanceolate. Roxburgh remarks that every part of the plant is eaten by the natives, either raw or stewed in their curries. Edgeworth and Dr. J. L. Stewart have recorded its use as a vegetable in the Punjab and at Mooltan, and in the *Materia Medica of Western India* it is stated that shepherds are fond of the tubers, which they consider to be tonic and digestive. R. Brown notices the use of *C. juncea* as a vegetable, and we have also observed that *C. tuberosa* is not distinguished by the natives from *C. bulbosa*. On the Nilgiris the tubers of *C. pusilla* are known as "Chutlan-killangu," and are much appreciated as an article of diet.

The tubers when boiled lose their bitterness, and pulped with milk form a sweet mucilaginous mixture not unlike salep, which, judging from their chemical composition, should be highly nutritious.

Description.—Root tuberous, a little flattened like a turnip, with several fibres from its base; it is about as large as a small apple. Stems twining, herbaceous, smooth, succulent; from 2 to 4 feet long. Leaves opposite, short petioled, obovate with a small point, entire, fleshy; size various. Umbels lateral, length of the leaves, peduncled, few-flowered. Flowers pretty large, erect, tube greenish, border purple. llicles two, slender, singly, about 3 or 4 inches long. (*xburgh.*)

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Chemical composition.—The tubers yielded on analysis—

Moisture	5·25
Fat	3·30
Sugar, gum, &c.	23·40
Albuminoids	3·48
Starch	42·52
Crude fibre	12·64
Ash	9·43
	100·00

The bitter principle of the tubers is an alkaloid, *Ceropegine,* soluble in ether, alcohol and water. The total nitrogen afforded by burning with soda-lime was 0·55 per cent. The ash contains manganese, and is constituted as follows:—

Soluble in water	61·7
Soluble in acid	14·9
Insoluble	23·4
	100·0

Caralluma attenuata, *Wight Ic., t.* 1268, Pulambari (*Tel.*), is used on the Eastern coast for ostensibly regenerating stale toddy. From information received from an Abkari Inspector, it appears that the bruised fresh plant is added to toddy to increase its gravity, and to give it the appearance and smell of that recently drawn. The toddy may be several days old, but so complete is the process of renewal that experienced judges are often deceived. The plant is acrid and bitter, and contains a caoutchouc-like substance, a resin similar to fluavil and a bitter principle, and so far resembles the Calotropis.

The Sanskrit names Kshiri, Kshirini, Kshira-kshava, Dugdha, Dugdhika, Dugdhapásháua, &c., are loosely applied to a number of milky plants, but more especially to the edible Asclepiads, such as **Oxystelma esculentum, Holostemma Rheedii, Caralluma edulis** and **fimbriata.** These plants as well as other Asclepiads are also called Yugmaphalottama, and Uttama-phalini, in allusion to their "twin

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pods," which are favourite vegetables of the Hindus. The central portion of the flowers of **Holostemma Rheedii, Cosmostigma racemosum,** and **Periploca aphylla** is sweet and is eaten by the natives. The acidulous and somewhat bitter stems of **Caralluma edulis** are eaten as a vegetable in the Punjab. The roots of **Holostemma Rheedii, Pentatropis spiralis** and **microphylla,** and the follicles of **Marsdenia Roylii** are considered to be cooling, and alterative, and are used in alterative decoctions and as a remedy in gonorrhœa. **Sarcostemma brevistigma** yields an abundant bland milky juice; this plant and **Periploca aphylla** are used as substitutes for the *Soma* of the Vedas, which from recent investigations appears to have been a species of *Ephedra,* and the same plant which is still brought from Persia to India as the *Homa* of the Parsis. **Stapelia reflexa** is used by the Afghan mountain tribes as a bitter tonic and febrifuge, and **Bouceriosia Aucheriana** is considered to have similar properties. Dr. G. Bidie has shown that **Secamone emetica,** notwithstanding its specific name, is almost inert.

LOGANIACEÆ.

STRYCHNOS NUX-VOMICA, *Linn.*

Fig.—*Bedd. Fl. Sylv.*, *t.* 243; *Bentl. and Trim.*, *t.* 178; *Gärtn. Fruct.* ii. *t.* 179; *Rumph.* i. t. 25; *Rheede Hort. Mal.* i., t. 37. Poison nut, False Angostura bark (*Eng.*), Vomiquier (*Fr.*).

Hab.—Throughout tropical India. The stem, bark and seeds.

Vernacular.—Kuchila (*Hind, Beng.*), Kájra (*Mar.*), Yettie-kottai (*Tam.*), Mushti-vittulu, Mushidi (*Tel.*), Hemmushti (*Can.*), Kannirakkuru (*Mal.*), Bidara-laut (*Malay*).

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History, Uses, &c.—No mention of Nux-vomica can be found in the older Sanskrit medical works. A drug called Vishamushti, mentioned by Sarangadhara, has by some been supposed to be nux-vomica, but according to the Bhavaprakasha, Vishamushti has an edible fruit, and is called Karerua in Hindi. The latter work gives Kupilu and Kulaka as Sanskrit names for Kuchila, but these names are generally referred to a kind of ebony. Another Sanskrit name given to the drug in recently compiled works is Kurachilla, an incorrect form of Kuruchilla, "a crab," to which animal the seeds bear some resemblance in shape. We think there can be little doubt that nux-vomica was not used medicinally by the ancient Hindus, but the Hindi name Kuchila or Kuchula occurs in ancient Persian, and appears to be derived from the Sanskrit कुञ्च (kunch) to make crooked. We also find an unidentified plant called Kuchela, mentioned by Sanskrit writers, with the synonyms of Avi-karni and Viddha-parni; the name Kuncha-phala is also met with, but it may possibly be only an incorrect rendering of Kucha-phala, a term for the pomegranate. We can hardly suppose that a plant having such marked poisonous properties can have escaped the notice of the earliest settlers in India, and there can be no doubt that the wood has been in use from a very early date as one of the kinds of Mushadi in Southern and Western India. We also find that in the Indian Archipelago, which was colonised at a very early date by the Hindus, the wood is used as a popular remedy for dysentery, fevers and dyspepsia, under the name of Bidara-laut by the Malays. This name appears to be of Sanskrit origin and to be derived from Vidara, "splitting or rending," and lata, "a tree or shrub," in allusion to the tetanic spasms produced by over-doses of the drug.

In the Rájá Nirghanta two kinds of Katuka are noticed; one of these with the vernacular synonym Kedár-katuki is doubtless *Picrorhiza Kurroa*, the other Katukavalli with the Canarese synonym Tonremattu, which does not appear in the vernacular Nighantas, must, we think, be referred to the bitter woods used as lignum colubrinum. (See *Strychnos colubrina.*)

It has been supposed by some that nux-vomica was the Jouz-el-máthil of the early Arabian writers, but this drug is described by Ibn Sina as studded with thick thorns, and as producing torpor when eaten; it is considered by all the more recent Mahometan writers to be Datura. The Jouz-el-kai of the Arabs has also been supposed to be nux-vomica, but there would seem to be no foundation for such a belief, as it is described as having properties similar to Jouz-el-máthil, and is probably the fruit of a Trichilia. All the Indian Mahometan physicians describe nux-vomica under the name of Azáráki; of this drug Ibn Sina merely says it is a kind of Zabad-el-bahr (foam of the sea), a name given by the Arabs to the cuttle-fish bone; he adds that it is not used internally, but applied externally in skin diseases and sciatica. Haji Zein-el-Attár (A.D. 1368) is the first who clearly identifies *Azáráki* with the Indian drug *Kuchala*; he gives the same description of its uses as Ibn Sina, and says the antidotes for it are fresh milk and oil (these are the popular antidotes for it at the present day in India, but in Madras dog excrement is also used). In the Makhzan-el-adwiya *azáráki* is said to be a Syrian word, but it appears to us more probable that it has been manufactured by the Syrian physicians, who instructed the Arabs in Greek medicine, from the words *ἄζα* and *ῥαχία*, and that it intended to be a Greek rendering of the Arabic Zabad-el-bahr. The author of tht Makhzan gives *Kuchila* as the Indian Indian name for nux-vomica, but says it is best known in Hindustan (Northern India) as Nirbhedin (a Sanskrit word which signifies splitting asunder, derived from निर्भिद). Nux-vomica is not mentioned by Garcia d'Orta who was in Goa, where the tree is very common, about the middle of the 16th century—a tolerably clear proof that it was not used medicinally at that time—but his contemporary Valerius Cordus in Europe describes it accurately. The seeds do not appear to have been used medicinally until about the middle of the 17th century, but Rheede mentions the root as an established remedy in Malabar, and we have much earlier records of its use on the Western Coast as a substitute for the true *Lignum Colubrinum*, a drug

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held in high estimation as a tonic, antiperiodic and alexipharmic in Southern India under the name of Nágamushidi. On the whole we are of opinion that the Arabs were acquainted with nux-vomica seeds under the name of *azáráki*, but that they imagined them to be of marine origin,—a comparatively modern Arabico-Persian name for them is Fulús-mahi ("fish scales"); this is the more likely, as the tree is especially a native of the Western and Southern Coast districts of India, and the seeds like those of several other plants are liable to be carried to a distance by oceanic currents.

Ainslie speaks of nux-vomica as a drug which is little used; he rightly states that the pulp of the fruit is poisonous, and the authors of the *Pharmacographia* have since shown that it contains strychnine; nevertheless it is eaten by the hornbill and other birds. He also tells us that the Vytians are of opinion that if the seeds are not taken in sufficient quantity to cause death, they will produce mental derangement. Loureiro states that the seeds roasted to blackness are really useful, and can be given without danger in *fluor albus*. In the Concan small doses of the seeds are given with aromatics in colic, and the juice of the fresh wood (obtained by applying heat to the middle of a straight stick to both ends of which a small pot has been tied) is given in doses of a few drops in cholera and acute dysentery. In some districts small quantities of the seeds are taken, apparently as a stimulant, or in lieu of opium. They also enter into the composition of the *bakha* pills, used in the preparation of Mahwa and other country spirit (see *Bassia*). In European medicine strychnine is usually preferred to the crude drug in which the proportion of alkaloid varies considerably. In 1883 Professor Bentley drew attention to this fact as affecting the strength of the extract, stating that he had suffered serious personal inconvenience from the variation in strength of extracts prepared from different kinds of seed. This statement led to the examination of five samples of commercial nux-vomica by Messrs. Dunstan and Short, who found that the proportion of alkaloid contained in them ranged from 2·56 to 3·57 per cent. Subse-

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quent experiments conducted by Dr. Schweissinger showed that the German official preparations varied considerably in strength, he therefore proposed that the strength of the tincture should be fixed at 0·2 per cent. of alkaloid; and that of the extract at 15 per cent., which would practically agree with the standards adopted in the new *British Pharmacopœia*. It must be borne in mind, however, that the tincture and extract of nux-vomica contain brucine and other constituents, and that therefore its medicinal action may differ from that of strychnine; indeed they are considered by some to be more efficient than that alkaloid in atonic dyspepsia.

H. Beckurts (*Arch. der Pharm.*, 1890, 330—347) remarks that if the physiological action of strychine and brucine is as given by Falck 1 : 38·5, then little is accomplished by a total alkaloid determination; it would be more to the point to require a fixed percentage of strychnine and disregard the brucine (of which an equal quantity could always be assumed). An extract with fixed strychnine percentage and a brucine percentage varying within 1·8 per cent. is undoubtedly more reliable than an extract containing a fixed quantity of total alkaloid in which the strychnine present might vary 1·8 per cent.

Beckurts obtained the following alkaloidal percentages from nine samples of nux-vomica:—Bombay, 2 samples, 2·33 and 2·30 per cent.; Malabar, 1 sample, 2·66 per cent.; Cochin, 3 samples, 2·51, 2·41 and 2·81 per cent.; Madras, 2 samples, 3·42 and 1·53 per cent.; Calcutta, 1 sample, 2·40 per cent. In a total of ten determinations made, assuming strychnine and brucine to be present in equal proportion, the yield of strychnine varied between 2·17 and 2·38 per cent.

Physiological action.—Nux-vomica affects animals very unequally. Cold-blooded animals are destroyed by it, but there is a considerable difference of opinion regarding its physiological action upon serpents and fish. The frog is affected with tetanic spasms if $\frac{1}{1000}$ of a grain of strychnine in solution is applied to its back, previously dried so as to impede the elimination of the

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poison through the integument. It is well known in India that birds are comparatively insusceptible to the poison, and large doses of nux-vomica may be given to fowls without any injurious effect. Ruminating animals are less easily affected by strychnine administered with the food than other quadrupeds; dogs and rabbits are soon destroyed by it, whilst certain monkeys and some other animals are said to be comparatively insusceptible to its action. Injected into the circulation it probably affects all animals alike. Stillé and Maisch remark:—"The phenomena in the various cases in which its specific operation is developed consists of tremor, twitchings, and startings of the voluntary muscles, followed by tetanoid spasms, during which the heart's action is accelerated, the temperature raised, and the respiration and consciousness suspended. Between the spasms the circulation generally becomes normal, the consciousness returns, and cutaneous hyperæsthesia is observed, but the spasms may be renewed by any excitation, as a touch, a loud sound, or a sudden impression on the eye. Death may occur through asphyxia from tonic spasm of the respiratory muscles, by syncope, or by exhaustion. The heart continues to pulsate after the respiratory movements have ceased. Of these modes of death, that during spasm is by far the most frequent in cases of strychnine-poisoning. No lesion is uniformly found after death; the heart may be distended with black blood or empty, and, although congestion and serous effusion within the meninges of the brain and spinal cord are usual, they are not uniformly met with, and in the substance of these organs no characteristic alterations have been observed. Falck experimented on rabbits with brucine nitrate injected subcutaneously in doses from ·1 gram. to ·02 gram. per kilogram of body weight. He found that the symptoms induced might be arranged in three divisions:—

1st—Respiration is quickened, and in some cases a strange injection of the ear was noted: the pupils may be dilated,

2nd—Tetanic convulsions, trismus, opisthotonos, oppressed respiration and dilated pupils.

3rd—Moribund.

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According to Falck the minimum lethal dose for rabbits is ·023 gram. per kilo of body-weight. Strychnine kills 3·06 times quicker, the intensity of the action of strychnine relative to brucine being as 1 to 117·4. (*Vierteljahrsschr. f. Gerichtl. Med.*, *Band.* xxiii., p. 78, quoted by *Blyth on Poisons.*)

The experiments of Dr. W. H. Klapp (1878) led him to conclusions which may thus be summarized: 1, Strychnine produces no primary lesion of the nerve-substance proper. 2. Its convulsions are not cerebral. 3. It does not affect either the sensory or motor nerves at their periphery. 4. These nerves are unaffected by it in their course. 5. Its tetanizing effects depend upon its action on the gray matter of the spinal cord. 6. In small doses it excites the vaso-motor centre. In large doses it paralyzes that centre. 8. It slows the pulse by an immediate action upon the excito-motor ganglia of the heart. 9. It does not act on the pneumogastrics, but decreases the number of respiratory movements, at first from too little blood, and afterwards from too much blood flowing to the respiratory centres. 10. Artificial respiration always moderates the spasms, not by a reflex stimulation of the pneumogastrics, but by maintaining the oxygenation of the blood until the poison is eliminated.

It may, then, reasonably be believed—1, that strychnine does not act upon the muscles, the nervous extremities, or the nerve-trunks; 2, that it does act upon the nerve-centres in the medulla oblongata and medulla spinalis; and, 3, that it acts upon those centres first by stimulating them when given in small doses, and by exhausting them, and thereby exaggerating their reflex irritability, when poisonous doses are used, in this respect falling under the general law that the actions of small and of large doses of an active agent are antagonistic to one another. (Compare Poole, *Med. Record*, xix. 201.) The latter of the two effects is probably dependent, in part at least, upon the power of strychnine to contract the arteries and the heart and to slow the pulse. It is essentially through spasm, in so far as it throws the respiratory muscles into tonic

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contraction and by rendering the chest immovable, that it tends to produce asphyxia, with its usual symptoms of dark venous congestion of the eyes and interior of the mouth. This explanation renders clear the agency of artificial respiration in saving the life of animals in strychnine-poisoning (Richet, *Med. News, etc.*, Nov. 1880, p. 659), and the effect of keeping the frog's skin moist in preventing or delaying the fatal action of the poison upon this animal. In both cases the blood continues to be oxygenated until the poisonous excess of strychnine has been eliminated." (*National Dispensatory.*)

Strychnine is generally supposed to have no action upon the brain, but E. Biernaki (*Ther. Mntsh.* Aug. 1890) from experiments made upon rabbits under the influence of chloroform found that the excitability of the cortical portion of the brain showed a diminution in from 8 to 10 minutes after the administration of strychnine, this diminution of excitability reached its maximum in from 27 to 30 minutes, then remained stationary for a time (according to the dose given) after which the brain gradually recovered its normal excitability. This depressing action may be due to the hyperexcitation of the medulla oblongata and medulla spinalis, which takes place, *pari passu*, with the diminution of sensibility in the cortical portion of the brain, as excitation of one portion of the central nervous system is known to produce a depressing action upon another portion.

The inhibitory action of strychnine upon the functions of the cortical portion of the brain explains the favorable effects obtained by its administration in alcoholism, insomnia and other diseases in which there is hyperexcitability of the brain.

As regards the treatment of strychnine poisoning, the stomach should be evacuated and a brisk purgative administered. The native remedies, oil and milk, may be given to retard the absorption of the drug. If the convulsions have begun chloral hydrate or chloroform may be administered, and when asphyxia threatens artificial respiration should be resorted to. In modern medicine nux-vomica is prescribed with advantage in the catarrhal dyspepsia, accompanied by flatulence and want of contractile power in the intestines, which is so common in India. In such cases it appears to be preferable to the alkaloid strychnine. As a general tonic in relaxed conditions of the muscular system, and in delirium tremens, strychnine is an invaluable remedy. It is also used with advantage as a stimulant of the nervous centres in some forms of paralysis after the symptoms of irritation have subsided, and in sexual debility. Applied externally nux-vomica acts as an irritant, and if the skin is abraded its active principles may be absorbed and give rise to symptoms of poisoning.

Prof. C. Pavesi (*Bolletina Farmaceutiça*, 1881,) has demonstrated the antiseptic properties of the different species of Strychnos and their alkaloids, and suggests that the effectiveness of the species of Strychnos which are used in tropical countries against fevers and poisonous bites may possibly be owing to the antiseptic and anti-fermentative power of the alkaloids.

Lauder Brunton (*Practitioner*, Jan. 1888,) recommends strychnine in sleeplessness due to mental fatigue, caused by strain or worry, as preferable to opium, chloral and bromides. He has given $\frac{1}{200}$ to $\frac{1}{100}$ grain of the alkaloid, or 5 to 10 minims of tincture of nux vomica at bedtime, the dose being repeated if the patient wake within one or two hours.

G. A. Gibson (*Practitioner*, Dec. 1889,) strongly recommends the hypodermic injection of strychnine in cases of opium narcosis, or in any case of narcotic poisoning where there occurs any irregularity or interruption of the breathing that appears to threaten a failure of the respiratory centre.

Description.—The fruit is an indehiscent berry of the size and shape of a small orange, and of a rich orange-yellow colour; it is filled with a bitter gelatinous, white pulp, in which the seeds, from 1 to 5 in number, are placed vertically in an irregular manner. The seed is disc-like, or rather irregularly orbicular, a little less than an inch in diameter, by about a quarter of an inch in thickness, slighty concave on the dorsal, convex on the ventral surface, or nearly flat on either side, often furnished

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with a broad, thickened margin, so that the central portion of the seed appears depressed. The outside edge is rounded or tapers into a keel-like ridge. Bombay nux-vomica usually has a bevelled margin, and Madras an obtuse one. Each seed has on its edge a small protuberance, from which is a faintly projecting line (raphe) passing to a central scar which is the hilum or umbilicus; a slight depression marks the opposite side of the seed. The seeds are of a light greyish hue, occasionally greenish, and have a satiny or glistening aspect, by reason of their being thickly covered with adpressed, radiating hairs. Nux-vomica is extremely compact and horny, and has a very bitter taste. (*Pharmacographia.*) The wood occurs in the shops in pieces of variable length, and from ¾ to 1 inch or more in diameter; it is covered by a thin light brown bark, which on one side of the stem is rougher than on the other, and is marked by numerous small light-coloured elliptic corky warts. A transverse section shows numerous very fine medullary rays; touched with nitric acid the section is stained a dull orange red.

Microscopic structure.—The hairs of nux-vomica are of remarkable structure. They are formed as usual of the elongated cells of the epidermis, and have their walls thickened by secondary deposits, which are interrupted by longitudinally extended pores; they are a striking object in polarized light. The albumen is made up of large cells, loaded with albuminoid matters and oily drops, but devoid of starch. If very thin slices of nux-vomica are kept for some time in glycerine, they develop feathery crystals, doubtless consisting of the alkaloids. (*Pharmacographia.*) The corky layer of the bark is composed of cubical cells of a reddish brown colour; within this is a wide zone of thin-walled cells arranged in radial and at the same time concentric rows; then come several rows of light-coloured stone cells; and lastly, a tolerably wide layer of thin-walled cells in which a few stone cells are scattered.

Chemical composition.—The bitter taste and highly poisonous action of nux-vomica are chiefly due to the presence of strychnine and brucine. Strychnine, $C^{21}H^{22}N^2O^2$, was first met with in 1818 by Pelletier and Caventou in St. Ignatius Beans, and immediately afterwards in nux-vomica. It crystallises from an alcoholic solution in large anhydrous prisms of the orthorhombic system. It requires for solution about 6,700 parts of cold or 2,500 of boiling water; the solution is of decidedly alkaline reaction, and an intensely bitter taste, which may be distinctly perceived, though it contains no more than $\frac{1}{600000}$ of the alkaloid. The best solvents for strychnine are spirits of wine or chloroform; it is but very sparingly soluble in absolute alcohol, benzol, amylic alcohol or ether. The alcoholic solution deviates the ray of polarized light to the left. The discovery of Brucine was made in 1819 by the same chemists, in nux-vomica bark, then supposed to be derived from *Brucea ferruginea*. Its presence in nux-vomica and St. Ignatius Bean was pointed out by them in 1824. Brucine, dried over sulphuric acid, has the formula $C^{23}H^{26}N^2O^4$, but it crystallises from its alcoholic solution with $4H^2O$. It readily neutralises acids, forming crystalline salts. In bitterness and poisonous properties, as well as in rotatory power, it closely resembles strychnine, differing, however, in the following particulars:—it is soluble in about 150 parts of boiling water, melts without alteration a little above 130° C. In common with its salts, it acquires a dark red colour when moistened with concentrated nitric acid.

In nux-vomica as well as in St. Ignatius' beans the alkaloids, according to their discoverers, are combined with strychnic or igasuric acid; Ludwig (1873), who prepared this body from the latter drug, describes it as a yellowish brown amorphous mass, having a strongly acid reaction and a sour astringent taste; and striking a dark green with ferric salts.

Nux-vomica dried at 100° C. yields when burnt with soda lime 1·822 per cent. of nitrogen, indicating about 11·3 per cent. of protein substances. The seeds contain 4·14 per cent. of fat. Meyer found it to yield butyric, capronic, caprylic, caprinic and other acids of the series of the common fatty acids, and also one acid richer in carbon than stearic acid.

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Nux-vomica also contains mucilage and sugar. The latter, which according to Rebbling (1855), exists to the extent of 6 per cent., reduces cupric oxide without the aid of heat. When macerated in water, the seeds easily undergo lactic fermentation, not however attended with decomposition of the alkaloids. The stability of strychnine is remarkable, even after ten years of contact with putrescent animal substances. (*Pharmacographia.*)

W. R. Dunstan and F. W. Short discovered (1884) a new glucoside in the pulp of the fruit of *Strychnos Nux-vomica* to the extent of 4 to 5 per cent., and named it *Loganin.* This substance answers to the formula $C^{25}H^{34}O^{14}$. They have also shown that loganin is present in small quantity in the seeds and in preparations made from them. (*Pharm. Journ.* [3] XIV., 1025.)

In nine samples of nux-vomica seeds examined by Beckurts, the percentage of total alkaloids ranged from 1·53 to 3·42 per cent. The same chemist found the percentage of strychnine in ten determinations to vary between 2·17 and 2·38 per cent. (*Archiv. der Pharm.*, 1890, 330-347.) W. R. Dunstan and F. W. Short in a sample of seeds from Ceylon found as much as 5·34 per cent. of total alkaloids. They found the pulp of the fruit to contain 1·4 per cent. of strychnine and 1 per cent. of brucine. (*Pharm. Journ.* [3], XIV and XV.)

The wood and bark of *S. Nux-vomica* (Bidara Laut) have been examined by H. G. Greenish, who found 2·26 per cent. anhydrous brucine in the dry wood, and as much as 7·38 per cent. in the dry bark. No trace of strychnine could be detected. The bark of *S. Nux-vomica* has been found to contain varying amounts of brucine according to age: old bark, 1·68 per cent.; medium, 2·4 per cent.; and young bark, 3·1 per cent. (*Pharm. Journ* [3] IX., 1013.)

D. Hooper (*Pharm. Journ.* 1890) found the leaves of *S. Nux-vomica* to contain ⅕ of a per cent. of alkaloid consisting of brucine, but no strychnine could be detected.

Toxicology.—Nux-vomica is seldom used as a poison in India, probably on account of the difficulty experienced in powdering it. In Bengal, from 1880 to 1887, out of a total number of 1,766 cases of poisoning investigated by the Chemical Analyser to Government, only 3 were from nux-vomica. In the N.-W. Provinces and Oudh, during the same period, one case was observed in a total of 1,529 viscera examined. In the Punjab no case was recorded in a total of 1,871 viscera examined during the same period. In Madras, during the seven years from 1882 to 1888, three cases of poisoning with nux-vomica were recorded, all three occurred in 1886, and in all the nux-vomica had been mixed with orpiment. In Bombay Dr Lyon remarks that poisoning by nux-vomica is occasionally met with, the cases being generally suicidal or accidental; in the ten years ending 1884 he records one case of cattle poisoning by this drug. Among the causes leading to accidental poisoning may be mentioned the practise of nux-vomica eating, which many authorities state to be commonly practised in certain parts of India on account of its stimulant and aphrodisiac properties. (See *Chevers' Med. Juris.* p. 241.) Nux-vomica has been found by the Chemical Examiner at Madras to be sometimes added to arrack to increase its intoxicating effect. Accidental cases of poisoning with nux-vomica bark have also been recorded owing to its substitution for Holarrhena bark by ignorant druggists. In a case which occurred in Calcutta in 1882, the death of a child was traced to this substitution, and in a subsequent case, on a vendor's stock of Holarrhena bark being seized, about one-fourth of it was found to consist of nux-vomica bark.

Since the introduction of Strychnine into India as a medicine by Europeans, it has been not unfrequently used as a poison.

In Bengal the Chemical Examiner reported its detection in human viscera three times in 1880-81, once in 1881-82, once in 1882-83, twice in the remaining nine months of 1883, three times in 1885, and twice in 1886. In 1884 and 1887 no cases occurred, making a total of 12 cases of strychnine poisoning in 1,766 viscera examined.

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In the Punjab, during the period between 1879 and 1887, only two cases were recorded—one in 1879 and one in 1887.

The total number of viscera examined was 1871.

In the N.-W. Provinces and Oudh no case is recorded during the same period.

In the Madras Chemical Examiner's reports we find under the head of "Human Viscera Examined, Class A," that in 1882 strychnine was detected in 2 out of 152 cases; in 1883, in 4 out of 123 cases; in 1884, in 8 out of 85 cases; in 1885, in 4 out of 81 cases; in 1886, none; and in 1887, in 2 out of 76 cases; in 1889, in 3 out of 101. Under the head of "Suspected Attempts to Poison" strychnine was detected in the articles examined twice in 1882, once in 1883, and once in 1887. In 1884 one case of cattle poisoning by strychnine is recorded.

The Reports of the Chemical Examiner, Bombay, for the ten years ending 1884 show that out of 947 cases in which poison was detected, strychnine was found 17 times.

Cattle poisoning from eating the leaves of *S. Nux-vomica* has been observed in the Madras Presidency and Mysore.

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The following table, compiled by Assistant Surgeon C. L. Bose, Assistant Chemical Examiner to the Government of Bengal, shows the particulars of poisoning by Nux-vomica and Strychnia in India:—

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liqr. Strychnia.		
Bengal………………	1873	…	…	…	…	……	…	…	…	1	…	…	……	……………
Do. ………………	1874	…	…	…	…	……	…	…	…	1	…	…	……	……………
Do. ………………	1877	2	…	…	…	……	…	…	…	…	…	…	……	……………
Do. ………………	1878	4	…	1	…	……	…	…	…	…	…	…	……	"Of the four deaths from poisoning by strychnia, three were accidental and arose from strychnia having been in two instances mistaken for santonin. In one, a mother finding some medicines among her deceased husband's effects, set aside some powder which she took to be santonin, and subsequently administered a portion of this to two of her children. Both the children died, and the powder proved to be strychnia. In the other instance, the strychnia was sold from a dispensary in mistake for santonin. Both these accidents occurred in Calcutta. *Dur-*

														ing the previous year (1877-78) *a similar case came to this office from Sibsagar.* A labourer in a tea-garden at Golaghat asked a fellow coolie for some santonin for himself and his son. Both the man and the boy died some hours after taking the dose given. Strychnia was detected in the stomach of both."
Do.	1879	5	...	...	...	.....	...	...	...	...	...	...	......	"There were 5 deaths from poisoning by strychnia, against 4 in the previous year. Of these 5 cases only one was due to strychnia having been mistaken for santonin, against 3 deaths arising from a similar mistake in 1878-79."
Do.	1880	1	2	...	...	.....	1	1	...	5	2	...	......	"A somewhat rare form of poisoning by the bark of the strychnos nux-vomica occurred in Calcutta, in which a young child was given a strong decoction of nux-vomica bark, *kuchila,* instead of a similar preparation of the bark of the *Holarrhena antidysenterica, kurchi.* From the evidence which transpired, it appeared that the child had been suffering from dysentery, and a native practitioner, who had some repute in the treatment of that disease, ordered his specific, the prescription being directed to be taken to his own dispensary for compounding. The compounder

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Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases						Suspected substances in connection with cattle poisoning cases.	Remarks
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica	Liq. Strychnia.		
Bengal.—(*contd.*)	1880													incharge, an unqualified man, finding no *kurchi* bark in store, purchased some from a bunniah. *Kuchila* bark was supplied instead, and not being recognized, the prescription was duly dispensed. An 8-oz. mixture was sent, the dose being one tablespoonful and the child of 2 years of age; the decoction was, I believe, of such a strength that one ounce represented the extractive matter from an ounce of the bark. Half a dose was administered, and was followed by death in 15 minutes. Brucia was detected in the mixture, and also in the stomach and vomit." " *Kuchila* and *kurchi* bark have certain points of resemblance: bunniahs sell both, and after the poisoning case above referred to, the police obtained samples of *kurchi* bark from various

														sources. In one instance the same bunniah sold nux-vomica bark for *kurchi* successively to two purchasers. It is impossible to surmise to what extent the substitution of *kuchila* for *kurchi* bark has occurred, but it is perfectly evident that bunniahs do not recognize the importance of distinguishing between the two drugs."
Do.	1881	1	...	...	...	......	..	...	...	...	...	...	......	....
Do.	1882	1	...	...	1	......	..	...	1	5	...	1	......	"A fatal accident occurred in Calcutta by which a child was poisoned by the bark of nux-vomica, *kuchila* being substituted for *kurchi*. It appears that the child had been ordered decoction of *kurchi* bark, which is a bitter tonic and astringent. The drug was purchased from a bunniah, the medicine prepared, and its administration was followed by death." "The Civil Surgeon of Sibsagar forwarded a few pills and wrote as follows:—'The pills were made by a Dr. D. P. Dass of Calcutta, and are stated to cure dysmenorrhœa, amenorrhœa, leucorrhœa, menorrhagia, and uterine diseases. A female patient took one of the pills, and about an hour afterwards was seized with violent spasms and became comatose.' The pills were found to contain strychnia and brucia."

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Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	REMARKS.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica. (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
Bengal—(*contd.*)...	1883	1	...	1	...	......	...	...	...	2	...	...	......	
Do	1884	...	...	...	2	......	...	...	...	12	...	...	......	"The seeds of *strychnos nux-vomica* were detected in the stomachs of two individuals, and the bark or seeds of this tree amongst 12 of the substances suspected to be poison or to contain poison." "One of the two cases in which nux-vomica bark was detected in the stomach occurred at Pooree, where a native herbalist appears to have substituted nux-vomica bark for sahajmari bark. It was reported that Kapil Das, a Hindoo male, aged 35, ground together some bark of sahajmari, molasses, and ganja with water, and afterwards drank the mixture on the night of the 25th instant, and was found dead next morning with blood oozing from his mouth. Nux-vomica was detected in the stomach. The other case occurred at

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Shahabad. Debalakin Jalahin, a female, aged 30 years, was reported by the police to have died by eating opium. The relatives of the deceased stated that the death was due to cholera. The chemical examination detected nux-vomica."

"From Dinagepore, a case of alleged criminal poisoning by nux-vomica was reported. Nillo Nishya, a Hindu male, stated that, after taking his food, he felt a hot sensation in his mouth extending to his throat and stomach, and that this was immediately followed by vomiting. He suspected his wife of poisoning him, and had the house of his wife's paramour searched, and found there two flat beans and other herbs which were sent for chemical examination along with the vomited matter. The two beans were the seeds of *strychnos nux-vomica.* No poison was found in the other herbs or in the vomited matter. In a case of suspected poisoning at Purneah, a few packets of suspected substances were sent for examination, and nux vomica 'seeds' were detected in one of them."

"In a case at Tipperah, a Mohamedan male, named Jahan Buksh, died

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	REMARKS.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica.	Liq. Strychnia.		
Bengal.—(*contd.*)	1884													suddenly after taking some medicine which was administered to him for the relief of a colic pain. A few pieces of the bark, of which he was said to have eaten, were sent for examination, and identified, physically and chemically, as nux-vomica bark." "There seems to be little doubt but that a considerable number of deaths are annually caused in Bengal through the carelessness of herbalists and others in subtituting nux-vomica bark for the bark of a non-poisonous medicinal tree. "Considerable insight was obtained in the month of May last as to how this substitution may occur. Kurchi bark is in great repute amongst natives as a mild antiperiodic and tonic for children, and a decoction of kurchi bark is also used in many native hos-

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pitals. The apothecary of the Campbell Hospital when proceeding to make some decoction for hospital use, observed, amongst the kurchi bark, a piece of bark which he felt convinced was nux-vomica bark, and he reported the matter to Dr. Coull Mackenzie, the Superintendent of the Hospital. A second quantity of kurchi bark was sent for to the same native druggist who supplied the first lot, and this too contained several piece of nux-vomica bark. The police were then informed of the matter by Dr. Mackenzie. They proceeded to the shop of the druggist and seized the whole of his remaining stock of so-called kurchi bark, and forwarded the three lots of bark for chemical examination. Nux-vomica bark was found in all three lots in very large amount, making up about one-fourth of the entire quantity of the bark."

"One of the most remarkable features in the mortality returns of Calcutta is the enormously high death-rate from tetanus. During 1884, 1,204 deaths were registered under the heading of tetanus, and the mortality for 1884 in this respect was not unusually high. The large bulk of the

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia	Nux-vomica (bark or seed)	Ext. Nux-vomica	Liq. Strychnia.		
Bengal—(*contd*.)...	1884													cases which figure in the returns under this heading occur in children and infants; and such enormously high prevalence of tetanus has never been satisfactorily explained. As the symptoms of strychnia poisoning very closely simulate those of tetanus, it is worth considering whether or not many of the cases of alleged tetanus may not really be cases of strychnia poisoning, when it is remembered that the deadly nux-vomica bark has been proved on several occasions to have been substituted for, or mixed with, the relatively harmless *kurchi* bark, and that this latter bark is extensively used by the people for infantile ailments."
Do.	1885	3	...	...	...	......	4	...	...	5	...	...	3	The five substances in connection with cattle poisoning were found to be nux-vomica.
Do.	1886	1	1	...	...	......	2	..	...	2	...	...	......	
Do.	1887	...	..	...	...	......	1	...	...	5	...	...	1	
Do.	1888	1	...	...	1	......	1	...	...	1	...	...	......	
Do.	1889	1	...	...	...	......	3	...	...	3	...	...	1	

Bombay	1871	1	...	...	...	......	...	...	...	...	...	...	......	"In the case of poisoning by strychnia, the alkaloid was detected in the contents of the stomach and in the liver of a female. Marked symptons of poisoning by strychnia were present during life. The exact quantity taken was not known. It was, however, ascertained that 10 grains by weight of strychnia was in the deceased's house shortly before she was attacked with symptoms of poisoning. After her death no portion of this quantity could be found. Only three other case of poisoning by strychnia (all non-fatal) have come before me during the past five years. Dr. Chever's remark that "commonly as the nux-vomica finds a place among the Bazaar drugs of Bengal, it would appear that it is by no means frequently employed in this country as a means of destroying life' is thus fully supported by the experience of the Bombay Chemical Analyser's office."
Do.	1872	...	...	...	...	1	...	...	...	...	...	...	......	"The single case in which strychnia was detected was in some respects a curious one. A medical practitioner, resident in Bombay, sitting down to tiffin, cut off and gave to a favourite dog a piece of the meat before him. He was called away before he had time to eat any himself, and on his return

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liqr. Strychnia.		
Bombay—(*contd.*)	1872													about half an hour afterwards, found his dog dying. He naturally suspected that the meat he had given to the dog was poisoned and called in the police. On examination strychnia was detected in the contents of the stomach of the dog, but none could be found in the meat. The probable explanation of the case was that the dog had got hold of the poison from the police, who were at the time poisoning stray dogs in Bombay with strychnia."
Do.	1874	...	...	...	...	......	...	...	...	...	...	...	......	"The case in which strychnia was found was that of a man at Satara caught in the act of attempting to commit suicide by taking a white powder which on examination, proved to be strychnia. This he probably stole from the police, who use it for destroying dogs."

Do	....	1876 ...	...	...	...	......	2 ..	...	...	...	...	......	"Two cases in which strychnia was detected came under notice during the year. One of these, except from the rarity of the poison, was not of particular medico-legal interest. The second case was as follows:—Two patients in a hospital were ordered mixtures containing the Liq Hydrarg. Perchloridi of the British Pharmacopœia. The quantities ordered were respectively 45 minims every 3rd hour for patient A, and one fluid drachm every 3rd hour for patient B. Patient A who was under treatment for some of the symptoms of Locomotor Ataxy, having taken two doses of his mixture was found suffering from intense headache and spasms of the extremities brought on by the least draught of air; and subsequently furious delirium set in. Patient B took only one dose of his medicine and was attacked with tetanic symptoms. Further administration of the mixtures was stopped, and what was left of them was sent to me for examination. I found both mixtures to correspond to the prescriptions, except that mercury was absent from them, and strychnia present; and it subsequently became clear that in making up the prescriptions the Liq. Strychnia of the British Pharmacopœia had by mistake been

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
														substituted for the Liq. Hydrarg. Perchloridi which had been ordered.
Bombay—(*contd.*)	1878	2	...	...	...	......	2	...	...	...	...	...	......	"This poison was detected in 4 cases (two of them fatal cases) during the year. Of the two fatal cases, one was sent up from Kaira, and was the case in which a man was stated to have committed suicide by swallowing a packet of poison used for killing dogs. On analysis, the poison was detected in the contents of the stomach and in the liver of the deceased: the other fatal case came from Bassim in the Berars. In this case, a boy, aged 11, is reported to have eaten some sugar given to him by a compounder employed in a charitable dispensary." The boy almost immediately complained of a bitter taste, and some pain about the right ear, and soon afterwards laid down, became violently convulsed, and died in about 15 minutes. On

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examination, I detected strychnia in the contents of the stomach of the deceased. Of the non-fatal cases, one from Godra was a case where a constable, it is alleged, gave a man, also a police constable, two powders, stating that they were fever medicines. One of these powders the sufferer swallowed at about 3 P. M. After taking the powder a bitter taste and feeling of nausea was noticed, very soon after "followed by convulsive movements of the arms and legs, and generally of all the voluntary muscles." The convulsive movements were accompanied by intervals of relaxation of the muscles. During the spasms the body was bent backwards. "There was giddiness and confusion of thoughts, which afterwards merged into insensibility." The symptoms disappeared at about 12 P. M. The remaining powder on examination I found to be strychnia. The history of the other non-fatal case is thus detailed by the hospital assistant, Paranti dispensary:—"Complainant's wife gave bread to her daugher to eat, who complained of its bitter taste, upon which her mother tasted it, then her father (the complainant), as well as four or five men sitting at the time in the complainant's house, each and

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain a poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	REMARKS
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica	Liq. Strychnia.		
														all complained of its bitter taste. They, therefore, got another bread prepared out of the remaining flour from which the first bread was prepared and gave it to a dog. The dog ate the whole, and after about a quarter of an hour, it fell down trembling, became convulsed, and soon after died." The bread was sent for examination, and on analysis strychnia was detected in it. During the seven years previous to the year under report, only 5 cases altogether of poisoning, or alleged poisoning in which strychnia was the poison employed, came before this office. This year I have had to notice 4 cases, and it will be observed that in two of these, and perhaps in all, the employment of strychnia as a poison is traceable to its introduction into use for the purpose of destroying dogs.

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Bombay—(*contd.*)	1879	2	..	..	...	......	1	...	...	1	...	...	......	"In a case from Haveri, a packet containing seeds which on examination proved to be nux-vomica seeds, was forwarded with a request that I would state whether such seeds if administered to a pregnant female would be likely to cause abortion. Two fatal cases of poisoning by strychnia, one from Poona and the otherfom Dharamgaon (Khandesh District), were referred during the year. In the Poona case a boy, aged 5, died in about three quarters of an hour after eating some sweetmeat given to him and to his two brothers by, it was alleged, a police Havildar. Deceased's two brothers, finding the sweetmeat had a bitter taste, did not eat it. Strychnia was found on analysis in the contents of the stomach of the boy who died. The Dharamgaon case appears to have been an accidental one, arising out of some strychnia powders supplied to the police for the purpose of destroying dogs, having been mistaken for cinchona alkaloid powders supplied as a febrifuge."
Do.	1880	1	...	...	...	......	1	...	...	...	...	...	......	"Two cases came under notice during the past year in which strychnia was detected; one of these from Dharwar, was a case where this alkaloid was detected in the contents of the

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
														stomach of a hospital assistant, who, it was reported, had committed suicide while under the influence of liquor, by swallowing a quantity of strychnia. The symptoms in this case being somewhat peculiar, I transcribe from the report of the case the following account of them :—"Deceased, half an hour after taking the poison, was found lying on his cot on his stomach, and remained throughout in that position, returning to it every time an attempt was made to alter it. He could not answer questions. Respiration very hurried, rapid and stertorous. Jaws so firmly fixed that the stomach pump could not be used nor emetics efficiently administered; pulse quick and full at first; tongue much bitten and bleeding; eyelids firmly closed; *no convulsions*, merely slight muscular twitchings of face and arms. The second case was forwarded from

														Ratnagiri, and was one in which strychnia was detected in some vegetable powder found in a cup near the dead body of a man, who, it was suspected had committed suicide."
Do.	1883	...	...	...	...	......	1	...	...	1	..	...	......	"A case was submitted by the Bombay Police in which some quack pills were found to contain a minute quantity of strychnia."
														"A case from Haveri, in which a nux vomica seed was found in the contents of a packet suspected to contain poison."
Do.	1885	2	...	...	...	......	...	...	...	...	...	...	......	"Strychnia was detected in 2 cases, viz.—(1) In the contents of the stomach and liver of a young female who, it was reported, had committed suicide by swallowing powdered nux vomica seeds. This case was sent up from Sasvad (Poona District); (2) in a case which occurred in Bombay, where five prisoners, four of whom died, were accidentally poisoned by strychnia given to them by mistake for cinchona alkaloid."
Do.	1887	...	...	...	...	......	2	...	...	...	...	...	......	"The poison was detected in two cases during the year, from respectively, Dindori (Nasik District) and Ahmednagar. In the first the alkaloid was

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Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	REMARKS.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed).		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
Bombay—(*contd.*)	1887													detected in the vomit of a young man who attempted to commit suicide. The sufferer was the son of a police constable, and the strychnia swallowed by him was a portion of some issued to his father for the purpose of destroying dogs. In the Ahmednagar case, strychnia was detected in some fragments of bread and also in some powders sent for examination therewith. Two boys, aged respectively 9 and 4, sons of a police constable, abstracted some strychnine powders from their father's bag. Of these they used two in poisoning dogs. Subsequently they appear to have mixed a third with the bread sent for examination, and were about giving this bread to some boys when they were stopped by the Police schoolmaster. The powders sent along with the bread were found hidden under some rubbish in the school-room."

Do.	1889	...	...	...	...	......	...	...	...	2	...	...	......	(1) "A case from Nagar (Ahmednagar, district) in which some seeds and powders were recognized as nux-vomica seeds and chalk mixed with red lead. They were found on the person of some accused, but no further history was forwarded. (2) A case from Patan (Satara district) in which nux-vomica seeds and powder of arsenious oxide and sulphate of copper were forwarded for identification, no notes of the case being afforded."
N.-W. P. & Oudh.	1870	...	...	...	...	......	...	...	...	...	...	...	......	Strychnia—1. It is not mentioned whether the detection was in connection with human or animal poisoning cases.
Do. ...	1875	1	...	...	...	......	1	...	...	...	...	...	......	"Referred by the Superintendent of Tarai. This was a case of suicide, the person being Tarachand Bhaduri, an Assistant Surgeon at Kashipoor in the Tarai. After death two phials were found in his pockets, one empty and labelled "Prussic acid," the other labelled "Strychnia" and containing some of those substances. I made a careful search in the stomach and its contents for prussic acid but found none. I then tested for strychnia, and detected it by the usual process. From the history of

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed)	Ext. Nux-vomica.	Liq. Strychnia.		
														the case it would appear that this unfortunate man must have taken a large dose, as the symptoms of the poison were not only well marked, but he died in about 5 minutes after the first symptoms were observed."
N.-W. P. & Oudh (*contd.*)	1878	...	...	...	...	......	...	...	...	...	...	...	......	Strychnia—2. Detected in connection with human poisoning cases, but whether in the viscera or in the suspected substances it is not mentioned.
Do. ...	1879	...	...	...	...	......	...	...	...	...	...	...	......	Nux Vomica—1. Detected in connection with human poisoning cases, but whether found in the stomach or among the suspected substances it is not mentioned.
Do. ...	1881	...	...	...	...	......	1	...	...	1	...	...	......	"From Ballia. The substance examined was found to be nux-vomica. This is also a drug often to be found in bazaars and yet not much used as a poison."

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														"An officer of the Royal Artillery stationed in Meerut suspected that the tea made for him by his servants had been drugged with some poison used for killing mice, &c. I found the vermin killer contained a small quantity of strychnia, but I could not find a trace of this alkaloid in the tea."
Do.	1885	...	...	...	1	1	..		...	...	...	...	......	"From Azimgarh. This was a case of suicide in which it was supposed that the subject of it, a woman of name unknown, had taken powdered nux-vomica; but finding that death came too slowly she drowned herself. Small fragments of nux-vomica were found among the contents of the stomach, and strychnia, the active principle of nux-vomica, was also found in the substance of the stomach."
														"Cattle case from Sitapore concerning poisoning a horse—poison used was nux-vomica."
Madras	1879	1	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1880	...	...	...	...	......	...	...	...	2	...	...	......	"A woman was believed to have committed suicide with nux-vomica leaves. No fragments of the leaves or traces of strychnia were contained in the stomach. Some leaves which were sent up were found to be leaves of nux-vomica."

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Presidency.	Year.	Human viscera				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases						Suspected substances in connection with cattle poisoning cases.	REMARKS.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica. (bark or seed)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. Strychnia.		
Madras—(*contd.*)	1881	2	...	...	...	......	...	...	...	...	...	...	......	....
Do.	1882	2	...	...	...	......	2	...	...	...	...	...	......	"Strychnia was detected in viscera in two instances. One case may have been a case of suicide. In the other case a man who was suffering from leprosy seems to have been poisoned either accidentally or intentionally by his medical adviser. The medicine which was being used was found to contain a very large amount of strychnia and brucia with an immense quantity of pepper and ginger." "Nux-vomica seeds in powder were also found in a powder which a man was accused of having forcibly rubbed into the mouth of a woman before attempting to commit a rape upon her. The poison was also found twice in native medicines, the properties of which were required to be known."
Do.	1883	7	...	...	...	......	3	...	...	...	...	...	......	In seven instances strychnia was detected in the human viscera, and in three instances among substances suspected to be or to contain poison.

Do.	1884	8	...	...	...	......	...	...	...	...	...	...	1	“Strychnia was detected in three cases. One from Godavari was said to be a case of suicidal poisoning by opium; no opium was found. In the second case from Nellore, a woman was reported to have vomited, been purged, and died within three hours. The third case from Salem is remarkable, because the victim was said to have died twenty-four days before the *post-mortem* examination of the body was held, and nearly two months before the chemical examination of the viscera took place. The history of the case indicated the probability of death having been produced by some irritant poison administered by an enemy of long-standing, who was supposed to have recently been reconciled to the deceased.” No mention is found of the remaining five cases. Nux-vomica was detected in connection with the cattle-poisoning case.
Do.	1885	4	...	...	...	......	...	...	...	...	...	...	......	....
Do.	1886	...	...	...	3	......	...	...	...	...	...	...	......	The nux-vomica was mixed with orpiment in all of the three cases.
Do.	1887	2	...	...	...	......	1	...	...	...	...	...	......	In one case strychnia was discovered in large quantity where opium had also been used. The strychnia was detected not only in the viscera, but also in the urine which was drawn off *post-mortem*. The case was remark-

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Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (seed or bark.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux vomica (bark or seed)	Ext. Nux-vomica	Liq. Strychnia.		
														able from a medico-legal point of view, because the action of the strychnia was much delayed and modified by the opium taken along with it. The patient was taken ill at 10 A. M., and the symptoms then were occasional spasmodic contractions of the muscles of the upper extremities. Later on the temperature rose, but the spasms ceased. At 4 P. M. the patient vomited. At 7-15 P. M. he had a fit of convulsions and died. Zinc sulphate and apomorphia had been administered without effect.
Madras—(*contd.*)..	1889	1	...	...	...	......	...	...	...	...	...	...	......	"The corpse of a woman (widow) was dragged out of a well, and as the cause of death could not be ascertained at the inquest, the body was conveyed to the local dispensary by the police. On getting ready for the *post-mortem* examination, a dead fœtus dropped out of the winding sheet, *post-*

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mortem delivery having occurred on the way unnoticed by the bearers of the corpse. There were no signs indicating that any attempt to cause abortion had been made; there were no signs of drowning; the fœtus was seven or eight months old; and its delivery was accompanied by a total inversion of the uterus. Strychnia was found in the viscera sent. The occurrence of child-birth after the life of the mother had become extinct, without the aid of art, and indeed even after interment, has been recorded and vouched by many observers of established credit, the independent contractile power of the uterus, or cadaveric rigidity being stated to be the chief factors in the production of this accident. So-called "cadaveric spasm" also known to occur at or after death by strychnine poisoning, and to persist till true cadaveric rigidity comes on, disappearing only with it. In the present instance the body must have lain for about 18 hours in the water, cadaveric rigidity had all but passed away at the time of examination (only the upper limbs being slightly stiff) and no doubt expulsion of the fœtus occurred by the pressure of the gaseous products of putrefaction which filled the abdo-

Presidency.	Year.	Human viscera.				Animal viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.						Suspected substances in connection with cattle poisoning cases.	Remarks.
		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)		Strychnia.	Brucia.	Strychnia and Brucia.	Nux-vomica (bark or seed.)	Ext. Nux-vomica.	Liq. strychnia.		
														men. The possibility of this accident occurring is a point in obstetric jurisprudence, which should not be forgotten when examining the dead body of a female alleged to have miscarried.
Punjab.	1873	...	...	...	...	......	...	...	...	1	...	...	1	Nux-vomica was detected in connection with the cattle-poisoning case.
Do.	1879	...	...	...	...	......	...	...	...	1	...	...	1	"Nux-vomica is very rarely used for murder, as strychnia has one of the most bitter tastes known, suspicion would be at once aroused. During the last two years, only one case has been referred, that of a man poisoned by his wife by mistake, who gave him the drug by the advice of a fakeer as an aphrodisiac."
Do.	1880	2	...	...	...	......	1	...	...	...	...	...	......	"In one of the strychnia cases, a police officer took a quinine powder, as he supposed, from a drawer in which such were kept for distribution. From this drawer there were sent 93 powders of strychnine, each of 5 grains,

														along with a large number of powders of cinchona febrifuge and sulphate of quinine. It was not stated whether they had been made up to poison beasts."
Do.	1881	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1882	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1883	...	...	...	...	......	...	...	...	1	...	...	......	....
Do.	1884	...	...	...	...	......	1	...	...	2	...	...	......	....
Do.	1886	...	...	...	...	......	...	...	...	1	...	...	1	Used for procuring abortion. Nux-vomica was detected in connection with the cattle poisoning case.
Do.	1887	...	...	...	...	......	...	...	..	1	...	...	......	....
Do.	1888	...	...	...	...	......	...	...	...	3	...	...	......	....

The following cases of poisoning by nux-vomica and its alkaloids are recorded in Dr. Brown's Book on "Punjab Poisons":—

No. 108. "In a case which was brought to the Medical College, Calcutta, in 1880, an old man put five of the seeds into a vessel of water and allowed it to stand all night long; the next morning he drank off the water. About half an hour afterwards he began to feel giddy and unable to stand, and at length he had a fit. About three hours after he was brought to the hospital, not having vomited, and the stomach pump was used; as soon as the tube of this passed the throat a spasmodic attack was occasioned, in which all his limbs became stiff and remained so for about 3 minutes; after this ceased, the tube was conveyed into the stomach, which was throughly cleaned out, and a dose of opium was administered. There was no return of the fit, and the next day he was quite well. The above forms a good example of a very mild case of this form of poisoning."

"Case No. 48 of 1862, Umballa.—A man ate some sugar; soon after he complained of twitchings and spasms in the throat and limbs; he vomited and afterwards recovered; strychnia was detected in the sugar used."

"Case No. 134 of 1869.—Several persons partook of food in which nux-vomica seeds had been put; within a minute they complained of a bitter taste in the mouth, twitchings of the throat, and giddiness and vomiting occurred; they subsequently suffered from cramps and twitching in the limbs, dimness of sight and weakness, but fell asleep two hours afterwards and then recovered. Nux-vomica seeds and strychnia were found in the vomited matter."

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Collection.—Cochin nux-vomica is collected in the dry deciduous forests at the foot of the Travancore hills, and is sold to small native dealers at a low rate, who send it to the merchants. The Coconada nux-vomica is obtained from the Ganjam district and Godavery. The Madras seeds come from Nellore and several other parts of the Presidency. The dirty and discoloured seeds, such as those left by monkeys, hornbills and parrots only fetch half rates. The best seed is obtained by collecting the fruits, washing out the seeds and drying in the sun. The right of collection is sold by the Forest department over fixed areas, and in the upper taluks of the Godavery in 1889, 5,500 maunds were taken out on payment of seigniorage. The last Nellore sales fetched Rs. 12 per candy of 20 maunds, that is, Rs. 2-8-0 per cwt. in Madras. In the Concan the seed is collected in a similar manner by the Mhars and other outcastes, and is sold to the small dealers at an average rate of one anna per measure of about 4lbs.

Commerce.—Large quantities of nux-vomica are exported from India. The annual exports from Bombay amount to about 4,000 cwts., all shipped to the United Kingdom. Madras and Cochin export still larger quantities, and Calcutta rather less. An extensive business is done in this drug at Cocanada, from which port it is shipped to Calcutta, Madras, Alleppy, Cochin, Bombay and Europe. The bags are made up to contain 164—165 lbs. each, and are valued at Rs. 3 per bag.

Exports from Cochin.	Cwt.
1883-84	2,396
1885-86	10,787
1886-87	2,535
1887-88	7,575
1888-89	3,255
1889-90	17,716

STRYCHNOS IGNATII, *Berg.*

Fig.—*Rev. de Plant. Vasc. Filip. App., p.* 449. Saint. Ignatius' Bean (*Eng.*), Féve de Saint Ignace (*Fr.*).

Hab.—Philippine Islands. The seeds.

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Vernacular.—Papita, from Spanish Pepita (*Ind. Bazars*).

History, Uses, &c.—The seeds were first described in Europe by Ray and Petiver (*Phil. Trans.*, 1699, xxi., 44, 87), from information furnished to them by the Jesuit missionary Camelli, and probably were brought to India by Jesuit missionaries about the same date. They are described in the *Makhzan-el-adwiya* of Mir Muhammad Husain (A.D. 1769) as the seeds of a fruit, about the size of an orange, brought from the New World; of a hot and dry nature, an excellent remedy in cholera and obstinate vomiting, and useful in all cold phlegmatic diseases, such as asthma, dropsy, rheumatism, &c. The dose is one to two grains, with two or three peppercorns rubbed down in water. There is a lengthy account of the seeds in the *Talif-i-sharifi*, which the author informs us is chiefly compiled from European works. Lonreiro says:—"I have often given and seen others give a whole seed weighing one drachm rubbed in water or wine to buffaloes, horses, cows and swine as an anthelmintic." The plant, hitherto imperfectly known to European botanists, has now been fully described and figured by Don Sebastian Vidal y Soler, Chief of the *Commission de la Flora Forestal de Filipinas*, in their "*Revision de plantas vasculares Filipinas*," published at Manilla in 1886.

The seeds are not now used medicinally in Europe, but when cheap are readily purchased for the manufacture of strychnia. They are officinal in the United States.

Description.—St. Ignatius' Beans are about an inch in length, their form is ovoid, but by mutual pressure it is rendered very irregular, and they are 3 to 4 or 5-sided, bluntly angular or flattish, with a conspicuous hilum at one end. In the fresh state they are covered with silvery adpressed hairs; portions of a shaggy brown epidermis are here and there perceptible on those found in commerce; but in the majority the seed shows the dull grey granular surface of the albumen itself. Notwithstanding the different outward appearance, the structure of St. Ignatius' Beans accords with that of Nux-vomica. The radicle however is longer, thicker, and frequently somewhat

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bent, and the cotyledons are more pointed. The horny brownish albumen is translucent, very hard, and difficult to split. The whole seed swells considerably by prolonged digestion in warm water, and has then a heavy, earthy smell. The beans are intensely bitter, and highly poisonous.

Microscopic structure.—The hairs of the epidermis are of an analogous structure, but more simple than in nux-vomica. The albumen and cotyledons agree in structural features with those of the same parts in nux-vomica.

Chemical composition.—Pelletier and Caventou (1819) found the seeds to contain the same constituents, though in different proportions, as nux-vomica; they stated the yield of strychnine (still containing brucine) to be 1·4 per. cent. Geissler (1837) likewise found 1·5 per cent. of this alkaloid. F. F. Mayer (1863), on assaying ignatia with his solution, obtained from 2 troy ounces of the seeds 4·5 grains of strychnine and 13·73 grains of brucine, which correspond to 0·52 per cent. of the former and 1·43 per cent. of the latter. The dried seeds yield 1·78 per cent. of nitrogen, indicating about 10 per cent. of albuminoids. (*Pharmacographia.*)

Commerce.—The seeds sometimes reach India from the East *via* Singapore, or are imported from Europe. Value, extremely variable.

STRYCHNOS COLUBRINA, *Linn.*

Fig.—*Rheede Hort. Mal. vii., t.* 5.

Hab.—W. Deccan Peninsula, from the Concan to Cochin. The wood.

STRYCHNOS RHEEDII, *Clarke.*

Fig.—*Rheede Hort. Mal. viii., t.* 24. Serpent's wood (*Eng.*), Bois de couleuvre (*Fr.*).

Hab.—Malabar. The wood and leaves.

Vernacular.—Nága-musádi (*Tel.*), Modira-caniram (*Mal.*), Kuchila-lata (*Hind., Beng.*), Goagari-lakri (*Guz.*), Deva-kadu (*Mar.*).

History, Uses, &c.—The vernacular names we have given are applied to several scandent species of Strychnos, the wood of which is used medicinally in India, and is known in Europe as *lignum colubrinum.* In addition to the two plants placed at the head of this article, it appears to be probable that *S. Beddomei*, Clarke, *S. laurina*, Wall., and *S. cinnamomifolia*, Thwaites, yield some of the serpent's wood used by the natives, and it is well known that the wood of *S. Nux-vomica* is often sold under this name. Rheede (viii., p. 47), speaking of this wood, tells us that it is called *Pao de solor* or *Pao da cobra* by the Portuguese; and that the Malayalim word *modira* signifies mystax (μυσταξ), probably an allusion to the moustache-like tentacles of the plant. In addition to the well-known use of the wood, he says: "Folia cum zinzibere et lacte ad consistentiam unguenti cocta, arthritidem, *Vilvada* Malabaribus appelata abigit; balneum ex illis præparatum idem præstat." Vilvada is a term applied to neuralgic pains. The *arbor ligni colubrini* of Rumphius (1, 70) appears to have been *S. colubrina*; he states that it is used in Java as a febrifuge and anthelmintic, and also externally in certain skin diseases. This species is described by Rheede under the name of *Scheru-Katu-Valli-Caniram.* He says that the Dutch call it *Wild Klimmend Kraanoog;* that the bruised fruit is applied to the head in mania, that the root rubbed down with pepper is given to check diarrhœa, and that boiled with oil it is used as a liniment for pains in the joints. The bark and wood of the different species of Strychnos appears to be the Katukavalli of the Rájá Nirghanta, often confounded with Kutaja, the bark of *Holarrhena antidysenterica.* In the vernaculars the Sanskrit Katu, bitter, becomes Kadu, Karu, Kadva, Karva, Karo, Kaura, &c., and Kuta, a water pot, becomes Karva, Karua, Karaya, &c. These names are very loosely applied to many bitter medicines, and often lead to dangerous mistakes. Ainslie wrongly supposes *lignum colubrinum* to be the *Dand-el-sini* of Ibn Sina. The latter writer, speaking of Dand, says:—
الصيني مدر كالفستق والسنجري مثل الخروع الاحمر منقط
بوعر والهندي اصغر من الصيني واكبر من السنجري

i.e. Chinese Dand is like a pistachio nut, and the kind called Sanjari is like a red castor seed, marked with rough patches. The Indian Dand is smaller than the Chinese, but larger than the Sanjari. *Dand* is a Persian name for Croton and Castor seeds of different kinds, and is the equivalent of the *Hab-el-Khatai* (Cathay berries) and *Hab-el-Salátin* (Prince's berries) of the Arabs, who do not appear to have made use of *lignum colubrinum*. It is evidently a corruption of the Sanskrit *Danti*, and the Indian kind, smaller than the Chinese, is doubtless the seed of *Baliospermum axillare*, the Danti-vija of the Hindus.

Virey (*Histoire naturelle des Medicaments*, p. 191,) states that Bois de Couleuvre in an overdose occasions tremors and vomiting, but mentions at the same time that in smaller doses it may be considered as a useful vermifuge, and be given also with advantage in obstinate quartan agues. Guibourt considers that *S. Colubrina* yields the true lignum colubrinum, or Pao da Cobra of the Portuguese, but he is unable to decide whether the wood usually found in commerce is produced by this tree or by *S. Nux-vomica*. (*Hist. Nat.*, Ed. 1869, Vol. II., p. 557.) Its claims as an antiperiodic have been examined by Dr. Berdenis van Berkelow (*Schmidt's jahrbucher*, May 24, 1866, *Brit. and. For. Med. Chir. Rev.*, April, 1867, p. 527); after a trial with it in twenty-two cases quartan and tertian, he reports favourably of its action, and considers that from its cheapness it may advantageously be used as a febrifuge. In Bombay shops two kinds of lignum colubrinum (Goagari-lakri) are met with; the genuine and least common imported from Malabar, and the stems of *S. Nux-vomica* collected in the Concan; both are much used by the Hindus on account of their tonic properties in dyspepsia and malarious affections. In the dyspepsia of vegetarians, preparations containing strychnia are particularly efficacious, and the extract of nux-vomica in half grain doses, appears to have all the virtues of the lignum colubrinum. In the Concan the fresh leaves of *S. colubrina* rubbed into a paste with the kernel of the cashewnut are applied to suppurating tumors.

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Description.—The general structure of the bark resembles that of *S. Nux-vomica*, but it it of a rusty colour, and the small lenticels upon it, instead of being pale, are of a bright rusty brown. The pieces of wood vary much in size, and are more knotty and crooked than those of *S. Nux-vomica*; they are often as thick as a man's arm. The texture of the wood is closer, harder, and of a deeper colour; when touched with nitric acid it turns of a reddish orange. Under the microscope the zone of stone-cells in the bark is seen to be wider and more irregular than in *S. Nux-vomica*, and the cells themselves are bright yellow, and larger.

Chemical composition.—The wood was found by Pelletier and Caventou to contain strychine and brucine. H. G. Greenish (*Pharm. Journ.* [3] ix., 1013) confirmed the presence of both alkaloids in the bark and wood, the strychnine reaction being especially well marked in the alkaloid from the bark. His analysis gave 0·96 per cent. of alkaloids in the dry wood, and 5·54 per cent. in the dry bark.

STRYCHNOS POTATORUM, *Linn. f*

Fig.—*Roxb. Cor. Pl. i., t.* 5; *Wight Ill. ii., t.* 156; *Gärtn. Fruct. i., t.* 179. Clearing nut (*Eng.*).

Hab.—Deccan Peninsula, Prome, Ceylon. The seeds.

Vernacular.—Nirmali (*Hind.*, *Beng.*, *Guz.*), Nivali, Katak, Chilbij (*Mar.*), Chillbij (*Can.*), Tetrán-kottai (*Tam.*), Chilla-ginjalu (*Tel.*), Tetran-parala (*Mal.*).

History, Uses, &c.—This seed, in Sanskrit Kataka or Ambuprasáda (ambu, water; prasáda, clearness), has been in use in India from the earliest ages for the purpose of clearing muddy water. Kálidása says:—"the ignorant man is refined by the society of the learned as water is by the *Kataka*." Menu (vii. 67) alluding to the popular saying that to name the *Kataka* is sufficient to purify water, remarks: "Though to name the fruit of the *Kataka* purifies water, yet the water becomes not pure, *i.e.*, faith without works avails not."

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Kataka is mentioned by Susruta in his chapter on water. One of the seeds is usually rubbed hard for a short time round the inside of the earthen pot, and the water is afterwards poured into it and left to settle; the impurities subside and the water remains clear and tasteless. Medicinally *nirmali* rubbed down with honey and camphor is applied to the eyes to strengthen the sight and prevent lachrymation; it is also used in ulceration of the cornea and purulent discharge from the conjunctiva. (*Chakradatta.*) Mahometan writers state that it is cold and dry, that when applied externally to the abdomen it relieves colic; they also notice its use to strengthen the sight and as a remedy in snake-bite. The author of the Talíf-i-sharíff recommends it in irritation of the urinary organs and gonorrhœa. He directs four of the seeds to be powdered and mixed with a little curd of milk, to be tied up in a piece of cloth and steeped in water during the night. The infusion is to be taken in the morning. Ainslie says:—"The fruit, though when very young it is made into a preserve and eaten, is reckoned in its mature state amongst the emetics of the Tamool doctors in Southern India, given in powder in the quantity of about half a teaspoonful." The *clearing nut* has a place in the secondary list of the *Pharmacopœia of India*, and is there said to be used as a remedy in diabetes, on the authority of Kirkpatrick. A suggestion is also made that the nut would be of use if supplied to troops marching in the rainy reason, when little but muddy water can be procured.

Dr. Pereira. (*Pharm. Journ.*, 1850, Vol. IX., p. 478,) suggests that the property of clearing water possessed by these seeds depends upon the albumin and casein which they contain. If the seeds be sliced and digested in water they yield a thick mucilaginous liquid, which, when boiled, yields a coagulum (albumin), and by subsequent addition of acetic acid, it furnishes a further coagulum (casein).—(*Phar. of India, p.* 146.)

Description.—The seed is nearly orbicular, button-shaped, about ½ an inch in diameter and ¼ inch thick; round the border is a slightly prominent ridge, which marks the junction

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of the two portions of albumen constituting the bulk of the seed; at one point a slight irregularity of the ridge marks the situation of the radicle, from this runs a faintly projecting line to the umbilicus, which is central and well marked, a hardly perceptible depression marks the opposite side of the seed. The integuments are yellowish grey and covered with fine silky hairs. The albumen horny but not quite so hard as that of Nux-vomica. The embryo consists of a club-shaped radicle and two delicate heart-shaped cotyledons.

Chemical composition.—We found the seeds as difficult to powder as those of Nux-vomica, and they had to be treated in a similar manner before they could be pulverised. The powdered seeds were boiled with strong alcohol acidulated with sulphuric acid, caustic potash in slight excess added, and then acetic acid to acid reaction. The solution was then evaporated to dryness on the water bath. Benzole extracted traces of an oily principle when agitated with the acid extract. After separation of the benzole the still acid solution was agitated with ether, which extracted resinous matter which became of a deep yellow colour on the addition of alkalies. The aqueous solution was then rendered alkaline with carbonate of soda and agitated first with ether and subsequently with chloroform.

In both cases intensely bitter extracts were obtained, the ether extract exceeding that yielded by chloroform. These extracts were purified,* and afforded all the reactions for alkaloids, the special colour reactions in both instances indicating the presence of brucia, and it is interesting to note that the larger amount was found in the ether extract. Portions of these extracts were injected into frogs, but beyond inducing muscular irritability no tetanizing effects were induced. Acetates of the alkaloids were employed for the hypodermic injections. We failed in obtaining any reactions for the presence of strychnia in either of the extracts. We are not however prepared to state that other alkaloidal principles are not associated with brucia in the seeds. We noted that on the

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* We noted that the ether extract when first dissolved in dilute sulphuric acid, was of a yellow colour, but changed to grass green on standing.

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evaporation of the alcoholic tincture of the seeds acidulated with sulphuric acid, a beautiful violet coloration was developed on the sides of the capsule; we also obtained a similar reaction with Nux-vomica seeds. Phosphoric acid, however, failed to afford this coloration, and it was not afforded either by hydrochloric or acetic acids

GENTIANACEÆ.

GENTIANA DAHURICA. *Fisch.*

Fig.—*Act. Soc. Nat. Scr. Mos. iii.*, 63. Syn.—*G. Olivieri*, Griseb.

Hab.—Persia. The flowering tops.

Vernacular.—Gul-i-gháfis (*Indian bazars*).

History, Uses, &c.—Ibn Sina and the Eastern Arabs and Persians adopted a Persian plant called Gháfat as representing the Eupatorion of the Greeks. This plant is still sold in India under the name of Ghâfith or Ghafis. (*cf.* Vol. I., p. 582). It is described in the Burhán-i-katia as a plant one span in height, having a long blue flower and a very bitter taste. The entire plant is not unfrequently to be found in parcels of the drug which arrive from Persia. Aitchison (*Bot. of the Afghan Del. Com.*, p. 88,) speaking of *G. Olivieri*, says :—

"In great uxuriance on the sandy downs of the Bádghis, forming part of the sward along with several Carices. This is undoubtedly, as Boissier remarks, the Gentian of the hot country. It is in such profusion, that when in flower it gives a blue colouring to the downs." We are informed that it is called *Gul-kalli* by the Persian peasants from its being used to cure کلی (kalli) or ringworm of the scalp in children. Indian and Persian Mahometan physicians describe Gháfis as having leaves like hemp, and long blue flowers, &c.; they copy the description of the Agrimony plant from the Greeks, and ascribe

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to it the flowers of the Persian Gentian with which they are familiar. The medicinal properties attributed to it are those of Agrimony.

Description.—The drug, which is imported from Persia, consists of delicate quadrangular flower stalks, two to four inches in length, terminating when perfect in five flowers; one of these is terminal, the remaining four are in opposite pairs and on longish peduncles, with bracts as long as the peduncles. The corolla is funnel-shaped, about 1 inch in length, erect, five-partite; calyx five-partite; stamens five, alternate with the corolline segments; style single; stigmas two; fruit three-fourths of an inch long, one-celled, containing numerous small seeds; calyx and corolla persistent. The lower portion of the plant is sometimes to be found; it has the leaves of a gentian.

The entire plant is from 6 to 8 inches high, and very bitter.

Chemical composition.—The drug reduced to fine powder and treated with ether yielded 7 per cent. of extract, consisting almost entirely of a light yellow-coloured wax. The spirit extract contained a crystalline bitter principle, neutral in reaction, unaffected by alkaloidal reagents but precipitated by tannin. The residue, after treatment with ether and alcohol, swelled up on the addition of water, and a quantity of mucilage and red-colouring matter entered into solution.

Commerce.—The drug is an article of regular import from Persia, and sells at from 2 to 3 annas a pound.

Jintiyana.—Under this name Gentian root imported from Europe is sold in India, and is generally accepted by the hakíms as representing the Gentiana of Pliny and Dioscorides.* Mahometan writers describe Jintiyana as having purplish flowers, and give Pákhánbed as the Hindi synonym. The root sold as Pákhánbed in the bazars is that of *Saxifraga ligulata,* an entirely different plant. (*See* Vol i., p. 585.)

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* Dios. iii., 3; Pliny 25, 7.

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GENTIANA KURROO, *Royle.*

Fig.—*Royle Illus., t.* 68, *f.* 2; *Bot. Mag., t.* 6470.

Hab.—Cashmere and N.-W. Himalaya. The root-stock.

Vernacular.—Karú, Nilkant, Kamal-phúl (*Hind.*).

History, Uses, &c.—This drug is not mentioned by Sanskrit writers on Materia Medica. Their Katuki, in the vernaculars Katki and Karú, which is in general use all over India, is undoubtedly the root of *Picrorhiza Kurrooa.* In the *Dictionary of the Economic Products of India* (iii., p. 486,) it is stated that *G. Kurroo* is largely exported to the plains along with *P. Kurrooa* as the officinal Karu or Katki, but we have been unable to find anything like the root of a Gentian in the original parcels of that drug which arrive from the hills. We believe that all the references to this plant, as a drug in use in the plains, belong properly to Picrorhiza, and that *G. Kurroo* is only used in the Himalayas and northern districts of the Punjab.

Description.—The root-stock is perennial and creeping, terminating in knotty crowns from which spring numerous vertical rhizomes from 3 to 6 inches in length; the latter, which form the bulk of the drug, are bluntly quadrangular, about as thick as a goose-quill, and marked on each face by the remains of a closely set single vertical row of rootlets; they are also transversely wrinkled, and terminate in a scaly tuft consisting of the remains of leaves and flower stems. A transverse section shows that the rhizome consists of a central quadrangular woody portion, surrounded by a thick cortex, both of a light yellow colour, tough, and having the odour and taste of Gentian root.

Chemical composition.—The roots contain a bitter principle similar to that of the European species; it is soluble in water and alcohol, and is not thrown down by neutral acetate of lead, but is precipitated by ammoniacal acetate; and liberated from the precipitate by sulphuretted hydrogen. It can be extracted

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from an aqueous solution by agitation with benzine or ether, but more readily by chloroform. Ferric chloride does not precipitate it, nor does tannin. Sulphuric acid colours it reddish, and the dilute acid decomposes it with the production of sugar. The root also contains a yellow, transparent, brittle resin, resembling mastic, in softening at the temperature of the mouth; it is odourless and tasteless, neutral in reaction, and insoluble in alkaline liquors. The presence of this resin to the extent of nearly 20 per cent. of the dried root should at once distinguish this Gentian from other species.

SWERTIA CHIRATA, *Ham.*

Fig.—*Wall. Pl. As. Rar.* iii., *t.* 252; *Bentl. and Trim.*, *t.* 183. Chiretta (*Eng.*), Chiretti (*Fr.*).

Hab.—Temperate Himalaya. The plant.

Vernacular.— Kiráyat (*Hind.*, *Guz.*), Chireta (*Beng.*), Kirait (*Mar.*), Nila-vembu (*Tam.*), Nela-vemu (*Tel.*), Nelabevu (*Can.*), Nila-veppa (*Mal.*).

History, Uses, &c.—Kiráyat has long been an important article of the Hindu Materia Medica. It is mentioned by Susruta and other Sanskrit writers under the name of Kirátatikta, which means the bitter plant of the Kirátas, an outcaste race of mountaineers in the north of India. It is also called Anárya-tikta, "the bitter plant of the non-Aryans." Another Sanskrit name is Bhunímba, "ground-nim." The herb is much esteemed by the Hindu physicians on account of its tonic, anthelmintic and febrifuge properties, and is prescribed in masked forms of malarial fever in which the chief symptoms are dyspepsia; it is usually combined with aromatics, such as ginger and lemon grass.

It is also considered to be laxative, anthelmintic and alterative. In the Bhaishajya-ratnavali, a decoction is directed to be made of equal parts of chiretta, Tinosposa stems, raisins, emblic myrobalans and zedoary root. Chiretta is one of the 54 ingredients of the compound powder known as Sudarsana-

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churna, and it gives its name to a compound oil called Kirátáditaila, in which it is combined with 26 other drugs, mostly aromatics and stimulants. This oil is rubbed on the body in obstinate cases of ague, causing emaciation and anæmia. (*Bhaishajya-ratnavali.*)

Mahometan writers upon Indian drugs have identified Chiretta with the Kasab-ed-darira of the Arabs, and Calamus aromaticus of Dioscorides. Guibourt was also of the same opinion, but Fée and Royle dissent from it.

The author of the *Makhzan-el Adwiya* gives at the end of his article upon Kasab-ed-darira the following short summary of the manner in which Chiretta is used by the Hindu physicians:—

"They consider it to be cold and dry, light and flatulent; a remedy for colds and bilious affections, burning of the body, and the fever arising from derangement of the three humors which they call *sannipàt* (fever with delirium)." The plant was first described by Roxburgh under the name of *Gentiana Chirayita* in 1814. Ainslie notices it, and remarks that it appears to be much used in Bengal; it was probably rather a scarce drug in Southern India in his time, as he says little about it. In England it began to attract attention about the year 1829; and in 1839 was introduced into the Edinburgh Pharmacopœia. It is now official in the British and Indian Pharmacopœias, and is generally accepted as a valuable bitter tonic. In Western India it has a reputation as a remedy for bronchial asthma, and in some cases we have known it used with success.

Description.—The entire plant is collected when in flower, or more commonly when the capsules are fully formed, and tied up with a slip of bamboo into flattish bundles about 3 feet long, each weighing when dry from 1½ to 2 lbs. The stem, $\frac{2}{10}$ to $\frac{3}{10}$ of an inch in thickness, is of an orange-brown, sometimes of a dark-purplish colour; the tapering simple root, often much exceeding the stem in thickness, is 2 to 4 inches long and up to ½ an inch thick. It is less frequently branched, but always provided with some rootlets. In stronger speci-

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mens, the root is somewhat oblique or geniculate; perhaps the stem is in this case the product of a second year's growth, and the plant not strictly annual. Each plant usually consists of a single stem, yet occasionally two or more spring from a single root. The stem rises to a height of 2 to 3 feet, and is cylindrical in its lower and middle portion, but bluntly quadrangular in its upper, the four edges being each marked with a prominent decurrent line, as in *Erythræa Centaurium* and many other plants of the order. The decussate ramification resembles that of the other Gentians; its stems are jointed at intervals of 1 to 3 or 4 inches bearing opposite semi-amplexicaul leaves or their cicatrices. The stem consists in its lower portion of a large woody column, coated with a very thin rind, and enclosing a comparatively large pith. The upper parts of the stem and branches contain a broad ring of thick-walled woody parenchyme. The numerous slender axillary and opposite branches are elongated, and thus constitute a dense umbellate panicle. They are smooth and glabrous, of greenish or brownish grey colour.

The leaves are ovate, acuminate, cordate at the base, entire, sessile, the largest one inch or more in length, 3 to 5 or 7-nerved, the midrib being strongest. At each division of the panicle there are two small bracts. The yellow corolla is rotate, 4-lobed, with glandular pits above the base; the calyx is one-third the length of the petals, which are about half an inch long. The one-celled bivalved capsule contains numerous seeds.

The flowers share the intense bitterness of the whole drug. The wood of the stronger stems is devoid of the bitter principles.

Chemical composition.—At the request of the authors of the *Pharmacographia*, a chemical examination of chiretta was made by Höhn under the direction of Professor Ludwig of Jena. The chief results may be thus described. Among the bitter principles of the drug, *Ophelic Acid*, $C^{15}H^{20}O^{10}$, occurs in the largest proportion. It is an amorphous, viscid, yellow substance of an acidulous, persistently bitter taste, and a faint gentian-like odour. With basic acetate of lead, it produces an abundant yellow precipitate. Ophelic acid does not form an insoluble compound with tannin; it dissolves in water, alcohol and ether. The first solution causes the separation of protoxide of copper from an alkaline tartrate of that metal.

A second bitter principle, *Chiratin*, $C^{26}H^{48}O^{15}$, may be removed by means of tannic acid, with which it forms an insoluble compound. Chiratin is a neutral, not distinctly crystalline, light yellow hygroscopic powder, soluble in alcohol, ether and in warm water. By boiling hydrochloric acid, it is decomposed into *Chiratogenin*, $C^{13}H^{24}O^{3}$, and Ophelic acid. Chiratogenin is a brownish, amorphous substance, soluble in alcohol but not in water, nor yielding a tannic compound. No sugar is formed in this decomposition.

These results exhibit no analogy to those obtained in the analysis of the European gentians. Finally Höhn remarked in chiretta a crystallisable, tasteless yellow substance, but its quantity was so minute that no investigation of it could be made. The leaves of chiretta, dried at 100° C., afforded 7·5 per cent. of ash; the stem 3·7, salts of potassium and calcium prevailing in both. (*Op. cit. 2nd. Ed., p.* 437.)

Commerce.—Most of the chiretta of commerce is said to be collected in the Morung district of Nepal; it is packed in large bales, which contain about 1 cwt., and arrives in India about the end of March, when a stock may be laid in at about 2 annas per lb. An inferior kind, known as *Mitha kirayat*, "sweet chiretta," is frequently met with; it is sometimes packed separately, and sometimes mixed with the true drug, but can be easily recognised by the almost complete absence of the central pith, and by its deficient bitterness. This spurious chiretta has been noticed in the London market and described by Prof. Bentley. (*Pharm. Journ.* [3] v., 481.) It is said to be derived from *S. angustifolia*, Ham.

Elborne in 1883 noticed the occurrence of Munjit (Madder) stems in some bundles of Chiretta.

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Swertia decussata—*Nimmo, Wight Ill., t.* 157, *bis f.* 3 *f.*, Syn.—*Ophelia multiflora,* a native of the West Deccan Peninsula, is used under the name of Silájit as a substitute for chiretta. The whole plant is bitter, but the root is preferred, and is said by Dr. Broughton and others who have used it to be an excellent substitute for gentian. It is not an article of commerce, but is sold in the bazar at Mahableshwar under the name of Kadú, which simply means "bitter." The *S. corymbosa* on the Nilgiris, and the *S. pulchella* on the Pulneys, are used as tonics in place of the true chiretta.

Description.—Stem quadrangular, 4-winged, ascending densely leafy; leaves round ovate; stem clasping, 5-nerved, mucronulate, glabrous, decussate; cymes many-flowered; calyx divisions lanceolate, acuminate; corolla white, 4-divided, segments ovate, elliptic, their rounded pits surrounded by long fringes; filaments united at the very base; capsules large, cylindrical, erect; seeds minute. Root of the diameter of a quill, giving off two or three rootlets, covered with a whitish-brown epidermis, when dry wrinkled longitudinally, white internally, and brittle.

ENICOSTEMA LITTORALE, *Blume.*

Fig.—*Bot. Mag. ii., t.* 28; *Wight Ic. t.* 600.

Hab.— Throughout India, except in Bengal. The plant.

Vernacular.—Chhota-kiráyat (*Hind.*), Mámijva (*Guz.*), Nella-galli (*Tel.*), Vellurugu (*Tam.*)

History, Uses, &c.—This plant does not appear to have been noticed by Sanskrit writers on Materia Medica, but it is popularly known in many parts of India, along with several other bitter herbs as a kind of *Kiráyat.* It is most abundant in moist situations near the coast, and is also found in Tropical Africa and the West Indies. Roxburgh describes it under the name of *Gentiana verticillata*, but says nothing about its medicinal properties. In the *Pharmacopœia of India* it is noticed under the name of *Cicendia hyssopifolia*.

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According to Cleghorn it is much used by the natives of Madras as a stomachic, as in addition to its tonic properties, it is also somewhat laxative. (*Ind. Ann. of Med. Sci.* iii., *p.* 272.)

Description.—Root perennial, creeping, filiform. Stems herbaceous, simple, erect, from 6 to 12 inches high, four-sided, jointed; leaves opposite, sessile, lanceolate, 3-nerved, smooth, entire, 1½ to 2 inches long, by half an inch broad; flowers axillary, sessile, generally threefold, small, white; corolla funnel-shaped. The whole plant is bitter.

Chemical composition.—The aërial and subterranean portions of this plant were examined separately; the former gave 34 per cent. of dry alcoholic extract and 15·7 per cent. of ash, and the latter 15·5 per cent. of dry alcoholic extract and 10·4 per cent. of ash. The bitter principle from both portions appeared to be identical and to have the characters of a glucoside. It was left as a varnish-like residue from the evaporation of its solution in chloroform, and was also soluble in ether, benzol, alcohol and water. It gave a reddish-brown colour with strong sulphuric acid, which changed to a purplish tint after standing. The hydrolysis of the bitter principle with dilute hydrochloric acid resulted in the production of an agreeable aromatic substance, and the deposition of a flocculent light-brown colouring matter.

CANSCORA DECUSSATA, *Roem. et Sch.*

Fig.— *Bot. Mag. t.* 3066.

Hab.— Throughout India. The plant.

Vernacular.—Sankháhuli, Dánipola, Dánakuni (*Hind.*), Dánkuni (*Beng.*), Sankhvel (*Mar.*), Cansjan-cora (*Mal.*).

History, Uses, &c.—This plant is mentioned in Sanskrit medical works, under the names of Shanka-pushpi, Kambu-pushpi, Kambu-malini and Dandotpala, as a laxative, alterative, and nervine tonic. Chakradatta recommends the fresh juice of the plant to be given in doses of about an ounce in all sorts of insanity; he also prescribes it as a nervine tonic.

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It seems probable that the Sanskrit names are applied in different parts of the country to more than one species of Canscora. Rheede (*Hort. Mal. x., t. 52*), figures *C. perfoliata* with the Malayalim name of the *Cansjan-cora,* from which the botanical name of the genus has been derived. The different species of Canscora are bitterish annual plants which grow in moist situations during, or immediately after the rainy season. They have pink, yellow or white flowers, and are of no medicinal importance.

Description.—Stem about a foot high, perfectly erect (Danda-utpala), four-sided, angles very sharp, or rather membrane-winged, smooth, ramous, branches always opposite cross-armed, in other respects like the stem; leaves opposite, spreading, sessile, lanceolate, sharp-pointed, entire, smooth, 3-nerved, size various; flowers terminal and axillary, peduncled, the terminal ones three-fold, the axillary single, white; peduncles 4-sided; calyx large, 4-toothed, 4-sided, 4-winged; corol funnel-shaped, border irregular, 3-parted, the two upper segments equal and orbicular, the lower one 2-parted, with a deep groove, in the groove is lodged the fourth or large stamen; filaments four, inserted into the mouth of the tube, the lowermost longer than the other three; style single; stigma 2-cleft, segments recurved; capsule one-celled, many-seeded.

Other plants belonging to this Order which are sometimes used medicinally are the different species of **Exacum,** amongst which may be mentioned *E. tetragonum* in Northern India and *E. bicolor* in the Deccan Peninsula.

Erythrœa Roxburghii has been recommended as a substitute for Chiretta; it is a delicate little plant from 4 to 10 inches high, appearing in cultivated ground after the rains.

The root is small and fibrous, sparingly branched, the stem quadrangular and winged; lower leaves obovate-oblong, obtuse, those on the stem linear-acuminate; cymes dichotomous; flowers bright pink, starlike; capsules oblong, mucronate, ¼ of an inch long, dehiscing, 2-celled, covered by the long sepals and inflated silver-paper-like tube of the corolla.

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BORAGINEÆ.

CORDIA MYXA, *Linn.*

Fig.—*Delile Fl. Ægypt, t.* 19, *f.* 1 ; *Wight Ill., t.* 169 ; *Rheede Hort. Mal. iv. t.* 37. Small Sebesten Plum (*Eng.*).

Hab.—Throughout India. Egypt to Cochin-China. Australia. The fruit and bark.

CORDIA OBLIQUA, *Willd.*

Fig.—*Bedd. Fl. Sylv., t.* 245 ; *Wight Ic., t.* 1378. Large Sebesten Plum (*Eng.*).

Hab.—Western India. Punjab and Hindustan to Ceylon. The fruit.

Vernacular.—Lasora (*Hind.*), Bahubára (*Beng.*), Bhokar, Shèlvant (*Mar.*), Bargund, Gondani (*Guz.*), Naruvili (*Tam.*), Nakkera, Botuku (*Tel.*), Viri (*Mal.*), Doduchallu (*Can.*). The adjective *great* or *small* is added to these names to distinguish the two species.

History, Uses, &c.—The fruits of these trees are the Selu, Bahuvara, or Sleshmátaka of Sanskrit writers, the Sapistán of the Mahometans, and the Sebestens of old European works on Materia Medica. *C. Myxa* is supposed by some to be the κοκυμηλέα ἀιγύπτια of Theophrastus. The natives of India pickle the fruit of both trees. Medicinally the dried fruit is valued on account of its mucilaginous nature and demulcent properties; it is much used in coughs and chest affections, also in irritation of the urinary passages; in larger quantities it is given in bilious affections as a laxative. Mahometan writers describe two kinds of Sapistán; the greater (*C. obliqua*), the pulp of which is separable from the stone, and the lesser (*C. Myxa*), the pulp of which is adherent. The word Sapistán is an abbreviation of Sag pistán, which means in Persian 'Dog's dugs.' In Arabic they are called Dibk and Mukhitah, in allusion to their glutinous pulp. Both trees are minutely described by Roxburgh. According to Horsfield the bark of *C. Myxa* is used by the Javanese as a tonic. This tree is the *Vidimaram* of Rheede, the *Fruita d' Entrudé* of the Portuguese, and the *Arbor glutinosa* or *Kleeverige Boom* of Rumphius.

Description.—*C. obliqua* : Drupe oblate-spheroidal, about an inch or inch and a quarter in diameter, smooth, when ripe yellow; pulp in large quantity, soft, clear and very clammy, one-celled; nut nearly circular, laterally compressed, rugose on the outside, with a cavity at each end, the lower one deeper than the other, exceedingly hard, 4-celled, though rarely all fertile; seed solitary, ovate-oblong.

C. Myxa: Drupe globular, smooth, the size of a cherry, sitting in the enlarged calyx, when ripe yellow; the pulp almost transparent, very tough, and viscid; nut cordate, at both ends bidentate and perforated, rugose, somewhat 4-sided, 4-celled, but it rarely happens that all prove fertile; seeds solitary. (*Roxburgh.*) Both kinds of fruit when dry are shrivelled, and of the colour of a dry prune. The pulp of *C. obliqua* can be separated from the nut, that of *C. Myxa* cannot; on sawing through the nut a heavy disagreeable smell is observable.

Chemical composition.—The pulp of the fruit of *C. obliqua* freed from seeds had the following composition:—

	Per cent.
Moisture	12·85
Extracted by hot water	64·25
Sugar (by copper estimation)	29·76
Acidity neutralizing Na HO	0·23
Alkalinity of ash as KHO	3·06
Total ash	8·85
Ash in insoluble residue	1·52

The alcoholic extract solution in water gave no indication of an alkaloid, and was not rendered turbid with lime water. Sebesten plums appear to have properties similar to prunes, as they exert a gentle laxative action when taken in any quantity.

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A decoction of the bark of *C. Myxa* was not affected by iodine solution, and was only slightly turned green by ferric chloride. The alcoholic extract contained some white, transparent crystals belonging to the square prismatic system. They had no peculiar taste, were neutral in reaction and unaffected by alkaloidal reagents and the stronger mineral acids. The aqueous extract was dark-coloured, free from bitterness, and a substance like cathartin was precipitated from it by six volumes of alcohol. Nothing was found in the bark to account for its reputed tonic action. Some simple crystals of calcium oxalate were present, and the reduction of this salt to carbonate, by burning, contributed largely to the 12·75 per cent. of ash.

CACCINIA GLAUCA, *Savi.*

Syn.—*C. Celsii, Boiss. Fl. Orient iv. p.* 277.

Hab.— Persia. The herb and flowers.

Vernacular.—Gaozabán (*Ind. Bazars*). The flowers, Gul-i-gaozabán (*Ind. Bazars*).

History, Uses, &c.— A plant named βουγλωσσος is mentioned by Dioscorides, Paulus Ægineta, Pliny and other Greek and Latin writers as useful in the cold stage of fevers as a stimulant when added to wine.*

Dioscorides says of it, ἔοικε δε φλόμω φυλλον χαμαιπετές τραχύ τέ καὶ μελάντερον ὅμοιον βοός γλώσση "it has leaves like *Verbascum*, procumbent, but rough and blacker, like a bullock's tongue." Marcellus Vergilius, in his commentary upon Dioscorides, brings strong evidence in favour of the opinion that the Bugloss of the ancients was Borage, laying special stress upon the fact that Dioscorides, Paulus Ægineta, Galen and Pliny all mention its addition to wine to increase its stimulating effects, a well known use of the plant up to the present time.

Forskahl (*Desc. Anim.*, *p.* 146; *Flora* lxii.) identifies the Lisán-el-thour of the Arabs with Borage. The author of the *Makhzan*, with other Persian writers, assumes that the Gaozabán of Persia is the same as the Bugloss of the Greeks and Romans: he then unmistakably describes the leaves, flowers and fruit of the Gaozabán we now receive from Persia, and says that most of the drug comes from Gilán. He also mentions another kind with smaller leaves as coming from Azimábád in India. Mír Muhammad Mumin, in his *Tuhfat-el-Múminin*, says that in Ispahán and some other towns of Persia a kind of Gaozabán is called Marmakhúz, and has a small round blue flower. In Persia Gaozaban is used as a demulcent in colds and coughs, and the ashes are applied to cure scald head in children.

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* Diosc. iv, 123; P. vi.; Pliny 25, 40.

In India the drug has long held a high place in native practice as an alterative tonic in syphilitic, leprous, and rheumatic cases; it has also diuretic and demulcent properties. O'Shaughnessy (*Beng. Disp.*, *p.* 420,) notices it favourably, but there is some doubt as to the kind of Gaozabán used by him. Mr. M. Sheriff and others have suggested its use as an alterative instead of Sarsaparilla. It may be given in decoction (1 oz. to a pint of water) in doses of from 2 to 4 ounces three or four times a day. Whatever its alterative powers may be, there can be no doubt as to its mucilaginous and saline properties. Aitchison found the Persian Gáozaban growing abundantly in the Badghis and Khorasan as well as in the Hari-rud valley. He states that the root stock is eaten by the natives, and that it is laden with a most viscid juice, which seems to be palatable to the people of those parts. (*Trans. Linn. Soc. 2nd Ser. Botany, Vol iii.*, *Pt.* I., *p.* 83.)

Description.—The following description is drawn up from an examination of original bales of the plant and flowers imported from Persia:—Gaozabán is a large herbaceous, perennial plant with black woody rhizomes, 1 to 2 inches in diameter, and terminating in a knotty head, from which spring several angular stems, thickly studded with calcareous tubercles and armed with stiff, white, calcareous bristles. The leaves, which are very fleshy, entire, petioled, and of an ovate-acuminate shape, have a slightly waved margin; the largest seen were 8 inches long by 4½ inches broad, the cauline

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leaves were 4½ by 2 inches, gradually decreasing to 1 inch; both sides of the leaves are thickly studded with calcareous tubercles which support stiff, white, calcareous bristles. Heads of flowers scorpioid and branched, thickly studded with white stiff bristles; bracts lanceolate to linear lanceolate, bristly; calyx half an inch long, 5-partite; segments linear-lanceolate, bristly; peduncles very short when the plant is in flower, lengthening to half an inch when in seed, and becoming studded with calcareous spots; pistil hairy, bifid at the apex, double the length of the calyx; corolla one and a half inch long, half an inch wide at the throat, funnel-shaped, almost bilabiate, externally hairy, 5-lobed, two upper lobes longest, throat of corolla glabrous, naked; stamens five, attached, a few long, weak hairs between the stamens; the fruit consists of oblong rugose nuts, $\frac{1}{4}$ to $\frac{5}{16}$ of an inch long, supported upon bony cups one-twelfth of an inch in diameter. If long kept the flowers lose their deep blue colour and turn reddish.

Chemical composition.—In boraginaceous plants there occurs a nitrogenous substance differing from gluten, the solution of which in boiling water solidifies on cooling to an imperfect jelly, and is precipitated by acids. It is also precipitated by the alkaline earths and by most salts, but tannin merely clouds it. (*Braconnot, J. Phys.* 84, 274.) In Gaozabán this nitrogenous substance is particularly abundant.

The ash of the leaves and stalks of Gaozabán has been examined by Deshmukh (1884), with the following results:—Silica, 24·17; Carbonic acid, 15·71; Alumina with traces of iron, 1·87; Lime, 27·31; Magnesia, 2·77; Potash, 14·56; Soda, 9·51; Sulphuric acid, 1·79; Phosphoric acid, 1·06; Chlorine, 1·47.

Commerce.—Value, Goazabán, Rs. 7 per maund of 37½ lbs.; Gul-i-gaozabán, Rs. 12 per maund.

TRICHODESMA INDICUM, *Br.*

Fig.—*Wight Ill. t.* 172.

Hab.—Throughout India, except in the Bengal plain.

TRICHODESMA ZEYLANICUM, *Br.*

Fig.—*Bot. Mag. t.* 4820; *Jacq. Ic. Pl. Rar. ii., t.* 314.

Hab.—Deccan Peninsula and Ceylon. The herb.

Vernacular.—Jhingi, Jhingino (*Hind.*, *Mar.*), Kouri-buti, Ratmandu (*Punj.*), Gaozabán (*Sind.*).

History, Uses, &c.—These plants bear the Sanskrit names of Jhingi, Jhingini, Sirishika, Durbala and Ambu-sirishika; they are considered to be demulcent, alterative and alexipharmic; useful for the removal of phlegmatic humors, skin diseases, &c. The Hindi and Marathi names, which are derived from the Sanskrit, are applied in the vernacular to various rough or prickly objects; in Hindi Jhinga is a name for shrimps or prawns, and in Marathi Jhingi signifies rough hair or bristles, and also a stinging kind of fish. The authors of the *Makhzan-el-Adwiya* and *Tuhfat-el-Muminin* notice a small kind of Gaozabán with a round blue flower, which is probably a Trichodesma. *T. indicum* is mentioned in Spry's *Modern India* as being in repute as an antidote to snake poison. Dr. Walker (*Bombay Med. and Phys. Soc. Trans.*, 1840, *p.* 72,) notices the use of Indian Borage in the Deccan on account of its emollient properties. In the Punjab and Sind it is used as an alterative and diuretic like the Persian Gaozabán; in the latter province *T. Africanum* is also used under the name of *Pábarpáni.*

Description.—Bristly, with hairs springing from tubercles and also more or less villous, leaves mostly sessile-lanceolate or cordate-lanceolate, 1-4 inches long, tuberculate on the upper surface; lower pedicels often distinctly axillary, 1-flowered; clayx lobes (at least in fruit) cordate or hastate at the base, ⅓—½ inch, more or less grey or white-villous; corolla tube ⅓ inch, lobes ⅕ inch, ovate, suddenly acuminate; staminal cone densely woolly on the back; nutlets ⅙ inch, sometimes very rough on the inner surface, obscurely margined. In the variety *amplexicaule*, the leaves are amplexicaul and strigose beneath on the nerves, but glabrous between them. *T. Zeylanicum* has usually denser and more softly villous racemes than *T. Indicum*, in other respects it hardly differs from it.

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Chemical composition.—Like others of the same family these plants afford a nitrogenous substance, differing from gluten, the solution of which in boiling water solidifies on cooling, and is precipitated by acids, alkaline earths, and most salts, whilst tannin merely clouds it. The ash contains silica, lime, magnesia, potash and soda, in combination with carbonic, sulphuric and phosphoric acids and chlorine.

Several other plants belonging to this order are used as substitutes for Borage, such as **Onosma echioides** and **O. bracteatum** in Northern India (*Stewart, Royle*), **Heliotropium ophioglossum** in Sind (*Stocks*).

ALKANET.

This colouring matter was well known to the Greeks and Romans as ἄγχουσα and Anchusa. It is mentioned by Theophrastus (vii., 9), Dioscorides (iv., 35, 36) and Pliny (22, 23). Dioscorides describes three kinds; it was used chiefly to colour medicines. Ibn Sina calls it انجوسا (anjusa); he gives Khass-el-himar "ass's lettuce" as the Arabic name, and quotes Galen's opinion of its medicinal properties; he also mentions several other names for the different kinds of alkanet. The author of the *Makhzan-el-Adwiya*, in his article upon Abu-Kalsa, gives various names for the four kinds of alkanet described by Mahometan writers; he states that Harjuya is the Persian, and Ratanjot the Indian name for them. In India the roots of *Onosma Hookeri*, Clarke, and of a species of Arnebia from Afghanistan, are known as Rang-i-badshah, "king's dye," and Ratanjot, and are chiefly used for colouring medicinal oils, &c.; a third kind of alkanet is imported from China, and consists of long, woody, twisted roots like the alkanet of Europe, which is chiefly derived from *Alkanna tinctoria*, Tausch, and is the *Orcanette* of the French. Alkanet imparts a rich red colour to spirit, ether, oils and fats, which is insoluble in water; with alkalies it gives fine blue colours. The name *alkanet* is derived from the Arabic الخنا (al-khanna), and was formerly applied to *Lawsonia alba*, Lam.

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HELIOTROPIUM INDICUM, *Linn.*

Fig.—*Wight Ill., t.* 171; *Rheede, Hort. Mal. x.*, 48. Indian Turnsole (*Eng.*).

Hab.—Throughout India. The herb.

Vernacular.—Háthi-shúra (*Hind.*), Hátisúra (*Beng.*), Bhúrúndi (*Mar.*), Tét-kodukki (*Tam.*), Télumani, Nágadanti (*Tel.*), Tél-kotakka, Teliyanni (*Mal.*), Háthi-sundhána (*Guz.*).

History, Uses, &c.—This plant is the Hasti-sunda of Sanskrit writers, it is also called Sri-hastini, from its being held in the hand of Sri or Lakshimi; it appears to be very generally used as an astringent and vulnerary in different parts of the world. It is the Bena Patsja of Rheede. Ainslie describes it under the name of *Heliotropium indicum.* Of its medicinal properties he says:—

"The juice of the leaves of this plant, which is a little bitter, the native practitioners apply to painful gum boils, and to repel pimples on the face; it is also prescribed as an external application to that species of ophthalmia in which the tarsus is inflamed or excoriated. The *Heliotropium indicum* is also a native of Cochin-China and of the West Indies; in the first mentioned country the natives call it Cay-boi-boi. Of its virtues, Loureiro says:—'Folia istius herbæ contusa maximé conducunt ad majores anthraces, vel, quando incipiunt, resolvendos, vel postea suppurandos.' (*Flor. Coch.-Chin., Vol. I., p.* 103.) It is well described by Browne, in his History of Jamaica (p. 150), and I find Barham (p. 42) tells us that it cleans and consolidates wounds and ulcers, and that boiled with castor oil it relieves the pain from the sting of a scorpion, and cures the bite of a mad dog!" (*Mat. Indica, Vol.* II., *p.* 414.)

In India also the plant is used as a local application to boils, sores, and the stings of insects and reptiles.

Description—An annual plant common in ditches where the soil is rich. The whole plant is more or less covered with simple hairs, stems several, as thick as the little finger, hollow, branched from the axils of the leaves; leaves generally alternate,

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cordate-ovate, rugose, long-petioled; petioles margined; spikes terminal, solitary, simple; flowers like those of the garden Heliotrope, but smaller; fruit mitre-shaped. The plant has a fetid odour like Stramonium; taste a little bitter.

Chemical composition.—The stems and leaves, besides containing a tannin soluble in ether, affording a dirty green coloration with ferric chloride, and an organic acid, non-crystalline, also soluble in ether, gave very marked evidence of the presence of an alkaloidal principle soluble in ether, and yielding marked precipitates with the ordinary alkaloidal reagents: with potassic chromate it afforded no precipitate, and it gave no special colour reactions. It was tasteless.

Heliotropium Eichwaldi, *Steud. Eichw. Itin. Casp-Caucas* 10, *t.* 4, differs little from *H. europeum*, Linn. Its leaves, boiled in castor oil, are said by Murray to be used in Sind to relieve the pain of scorpion stings, and also for cleansing and and healing ulcers. *H. brevifolium* and *H. undulatum* are used for similar purposes in Northern India. The ἡλιοτρόπιον το μέγα of the Greeks (*Theophr. H. P. vii.*, 8, 9, 10; *Diosc. iv.*, 195,) is supposed to have been *H. europeum*, the same plant was the Herba Solaris of the Romans, and was used by the ancients to expel bile and phlegm, and locally applied to scorpion stings. P. L. Simmonds (*Amer. Journ. of Pharm.* Feb. 1891) states that it contains a toxic alkaloid. It obtained its name from a myth which is related by Ovid (*Metamorph. Lib. iv., Fab.* 6), in which the nymph Clytie in love with the Sun was turned into this plant, but still retained her affection for her lover.

"Membra ferunt hæsisse solo: partemque coloris.
Luridus exsangues pallor convertit in herbas.
Est in parte rubor, violæque simillimus ora
Flos tegit. Illa suum, quamvis radice tenetur.
Vertitur ad solem: mutataque servat amorem."

"Her looks their paleness in a flower retained,
Still the lov'd object the fond leaves pursue,
Still move their root, the moving Sun to view,
And in the *heliotrope* the nymph is true."

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Plants of minor importance belonging to this Order, which are used medicinally, are:—

Ehretia buxifolia, *Roxb. Cor. Pl. i., t.* 57, a shrub of the Deccan Peninsula, called *Kuruvingi* in Tamil, the root of which, according to Ainslie, is sweet and slightly pungent when fresh, and is used as an alterative in cachexia and syphilis; the Mahometans consider to be an antidote to vegetable poisons.

Ehretia obtusifolia, *Hochst.*, a native of Sind and the Punjab, is considered to have similar properties.

Coldenia procumbens, *Linn., Lam. Ill., t.* 89, a common weed in rice fields during the cold season, known to the natives as Tripakshi or Tripankhi, is, when dried and powdered, made into a paste with an equal proportion of powdered fenugreek, and applied to boils to promote maturation.

CONVOLVULACEÆ.

IPOMÆA TURPETHUM, *Br.*

Fig.—*Bot. Reg., t.* 279; *Bot. Mag., t.* 2093.

Hab.—Throughout India and Ceylon. The root. Turpeth root.

Vernacular.—Nisot, Nákpatr, Pitohri (*Hind.*), Teori (*Beng.*), Shivadai, Shivadai-vér (*Tam.*), Tegada, Tegada-véru (*Tel.*), Chiváka-véra (*Mal.*), Tigadikeputigadi (*Can.*), Nishottar, Tartari, Shetvara, Phutkari (*Mar.*), Nishotar (*Guz.*).

History, Uses, &c.—This drug, which bears the Sanskrit names of Triputa, "three-angled," Trivrit, "three-fold," Kutaruná, Tinti and Nindika, is described in the Nighantas as pungent, cathartic, dry, sweet and hot; a dispellent of wind, fever, phlegm, bile and melancholy, and bitter and digestive. Sanskrit writers mention two varieties, Sveta—"white," and Krishna or Shama, "black"; the latter kind bears the names of

Kálá, Kálaparni and Kálámeshi, and is described as a violent purgative. Its source has not been satisfactorily ascertained, but it is supposed to be the root of *Lettsomia atropurpurea*, Clarke, a native of Nipal and Sikkim. *I. Turpethum* is sacred to Siva, to whom the flowers are offered by the Hindus. It is one of the most common native cathartics, and has probably been in use all over India from a very early date. The usual method of administration is to rub down about a drachm of the root or stem with water, and add to it some rock salt and ginger, or sugar and black pepper. Under the name of *Turbud*, an Arab corruption of Triputa, Mahometan writers also mention two kinds, white and black, and direct the black to be avoided on account of its poisonous properties, which are said to resemble those of Hellebore. As regards the properties of Turbud they say that it is a drastic purgative of phlegmatic humors and bile; its action is promoted by combination with ginger; it is particularly beneficial in rheumatic and paralytic affections. Combined with chebulic myrobalans it is useful in melancholy and dropsies.

Ainslie says—"The *Convolvulus Indicus alatus maximus* had long a place in the British Materia Medica, but of late years has fallen into disuse. I find it mentioned by Avicenna under the name of Turbud; but the first among the Arabs who prescribed it was Mesue (see *Spreng., Rei Herbariæ, Vol.* 1, *p.* 249), also Rhazes (c. 173). Alston in his Materia Medica speaks of turpeth as a strong and resinous cathartic, and recommended in his days in gout, dropsy and leprosy. The plant is known to the modern Greeks by the name of τουρπεθ; it is a native of the Society and Friendly Isles, as well as of India, of the New Hebrides and of New Holland. Virey, in his *Histoire Naturelle des Medicaments* (p. 184), speaks of the root of the *Convolvulus Turpethum* as more drastic than the common jalap, which, however, it does not seem, is to be found in India." (*Mat. Ind.* II., *p.* 384.)

Wallich, Gordon, and Cass considered this drug to be of considerable value as a cathartic. Sir W. O'Shaughnessy (*Beng. Disp.*, *p.* 504) found it so uncertain in its operation that

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he pronounced it unworthy of a place in the Pharmacopœia. In this opinion he is undoubtedly correct, as the active resins are present in the root in a much smaller proportion than in jalap, but as the drug is very cheap it might be used with advantage for preparing the commercial resin. Turpeth when administered by the mouth excites irritation of the stomach with nausea, colic, and watery, mucous stools; in excessive doses it excites inflammation of the gastro-intestinal mucous membrane and bloody dejections. Like jalap it is an hepatic stimulant, increasing the secretion of biliary matter and rendering it more watery. Being a hydrogogue cathartic it is useful for the removal of dropsical effusions, and in such cases it acts best in combination with ginger and bitartrate of potash. The dose should be about double that of the ordinary jalap powder of commerce, equal to from 4 to 5 grains of the resin.

Description.—The Turpeth of commerce consists of the root and stem of the plant cut in short lengths, usually from ½ to 2 inches in diameter; the central woody portion is often removed by splitting the bark on one side. The exterior surface has a twisted rope-like or columnar appearance, and is of a dull grey colour, a transverse section shows a porous surface of a dirty white colour, and loaded with pale yellowish-white resin; through this substance pass numerous bundles composed of large vessels and woody fibre. The drug is free from smell, but has a nauseous taste, which is only perceptible after it has been some time in the mouth. In some specimens all or a portion of the central wood remains; it resembles a piece of rattan cane. Black *nisot* presents a similar appearance, but is of smaller size and of a darker colour.

Microscopic structure.—The epidermis consists of tabular brown cells; the parenchyma is starchy, in it are thickly scattered very large resin cells and numerous rosette-like raphides; the many large vascular bundles are composed of large dotted vessels surrounded by wood fibres, each of the prominent external ridges of the bark contains one of these bundles.

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The central cane-like woody column of the root or stem when present is seen to be divided into four parts by four bands of parenchyma (medullary rays); it consists of large dotted vessels connected together by narrow portions of woody fibre.

The black *nisot* has exactly the same structure as the white.

Chemical composition.—Turpeth resin consists of a small quantity of soft resin soluble in ether, and of a substance insoluble in ether, benzine, bisulphide of carbon and essential oils. This substance has been named *Turpethin* ($C^{34}H^{56}O^{16}$), and is present in the root to the extent of 4 per cent.; it has been examined by Spirgatis, who describes it as a grey powder having a powerfully irritant action upon the mucous membranes of the mouth and nose, and being analogous in its reactions with jalapin and convolvulin. Under the action of alkaline bases it is transformed into turpethic acid, and in the presence of hydrochloric acid becomes converted into glucose and turpetholic acid. (*Zeitschr. der Chemie und Pharmacie*, 1865.) Turpeth resin is supposed to have a resemblance in colour and action to *Turpeth mineral,* an old name for basic sulphate of mercury.

Commerce.—The price of the drug in Bombay is about Rs. 2 per maund of 37½ lbs.

IPOMÆA HEDERACEA, *Jacq.*

Fig.—*Jacq. Icon., t.* 36; *Bentl. and Trim., t.* 185. Syn.—*Pharbitis Nil,* Chois.

Hab.—Throughout India. The seeds.

Vernacular.—Mirchai, Káladana (*Hind.*), Nil-kolomi, Káladana (*Beng.*), Kodi-kákkatan-virai, Jiriki-virai (*Tam.*), Jiriki-vittulu, Kolli-vittulu (*Tel.*), Káladana (*Guz.*), Nilapushpi-che-bij (*Mar.*). The same vernacular names are often applied to the seeds of *Clitorea ternatea.*

History, Uses, &c.—These seeds do not appear to be noticed in Sanskrit works on Materia Medica. Under the Arabic name Hab-un-níl and the Persian name Tukm-i-níl, the author of the *Makhzan-el-Adwiya* correctly describes the

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shape of the seeds, and colour of the flowers. As regards the medicinal properties of the drug he says that it is a drastic purgative and attenuant, relieving the system of bilious and phlegmatic humours, and acting as an anthelmintic. In some native works the seeds of *Clitorea ternatea* appear to be confounded with Káládána. The author of the *Makhzan*, though describing the latter article correctly, gives Aprajita (*Clitoria ternatea*) as the name of a kind of Hab-un-nil.

From the time of Roxburgh, and probably from an earlier date, the properties of the seeds have been known to Europeans, who have almost universally acknowledged their value as a safe and sure cathartic.

In the *Pharmacopœia of India* (1868) they were made official, and directions for preparing an extract, tincture, compound powder, and resin are given. These preparations are meant to supply the place of similar preparations of jalap. With regard to the extract, we would observe that no directions for separating the albumen and mucilage are given, consequently the result of the operation is an enormous bulk of almost inert extract, which in a short time becomes putrid. Five to ten grains of this extract have no perceptible effect as a purgative. The resin, first prepared by Dr. G. Bidie of Madras in 1861, appears to be the most satisfactory preparation; of this the dose is from 4 to 8 grains.

Description.—The seeds resemble in shape those of most of the Convolvuli, being in the form of a segment of a sphere; they are generally about $\frac{3}{16}$ of an inch in length, and nearly as much in breadth, but sometimes much smaller. Their weight varies from $\frac{1}{2}$ to nearly 1 grain. The colour of the testa is black, except at the umbilicus, where it is brown. Upon soaking the seeds in water the testa bursts and discloses the delicate albumen which envelopes the folded cotyledons and radicle. These have an acrid taste and earthy odour.

Microscopic structure.—From without inwards the testa consists of—1*st*, a layer of epithelial cells, the thick outer walls of which form conical projections; 2*nd*, a single layer of small quadrangular cells; *3rd*, a layer of radially elongated prismatic cells; *4th*, a zone of parenchyma, the cells of which are irregularly compressed. Within the testa is the thin layer of albumen, which contains much mucilage. The cotyledons are built up of polygonal cells; in their substance are cavities or passages which contain a yellowish oil.

Ipomœa muricata, *Jacq., Hort. Schoenb. iii.* 40, *t.* 323, *Bot. Reg. iv., t.* 290, a native of Persia and the Himalayas, is the source of the Tukm-i-níl imported into Bombay from Persia. Roxburgh says of it :—"I have only met with this in my own garden: it was raised from seeds sent from Persia and proves annual." It is noticed by Graham, who seems to regard it as a variety of *Calonyction speciosum* (*Bombay Plants*, No. 972). In Bombay it is common in gardens and upon waste ground, and it is a garden weed in many parts of the Concan, where it is known as *Bárik Bhauri*, or the lesser Bhauri, on account of the similarity of the calyx to that of *Porana racemosa* (Bhauri). The juice of the plant is used to destroy bugs. The Bombay plant is identical with the one we have obtained by sowing the Persian seed.

Description.—Annual herbaceous, climbing; root small, tapering, with many slender rootlets; stem branched, covered with soft prickles, not hairy; leaves broadly cordate, acuminate, smooth, on long petioles; flowers axillary, 2 to 4, on long peduncles having prickles like the stem; pedicles large, fleshy and club-shaped, of a light green colour, 1½ inches long; calyx divided; sepals 5, broadly ovate, mucronate, smooth, persistent; corolla purple, about 2 inches in diameter, expanding at sunset, and closing before sunrise; capsule two-celled, composed of 4 segments, which separate from the central partition; cells two-seeded; seeds dark brown, smooth, the same shape as those of Kaladana, about ⅓rd of an inch in length, and ¼ in breadth; weight about 3 grains each. They can easily be distinguished from Indian Kaladana by their greater size, lighter colour and thick testa; their medicinal properties appear to be identical with those of *I. hederacea*.

Chemical composition.—The authors of the *Pharmacographia* say:—"By exhausting the seeds dried at 100° C., with boiling ether, we obtained a thick light-brownish oil having an acrid taste and concreting below 18° C. The powdered seeds yielded of this oil 14·4 per cent. Water removes from the seeds a considerable amount of mucilage, some albuminous matter, and a little tannic acid. The first is soluble to some extent in dilute spirit of wine, and may be precipitated therefrom by an alcoholic solution of acetate of lead.

"The active principle of Kaladana is a resin, soluble in alcohol, but neither in benzol nor in ether. From the residue of the seeds after exhaustion by ether, treatment with absolute alcohol removed a pale yellowish resin in quantity equivalent to 8·2 per cent. of the seed. Kaladana resin, which has been introduced into medical practice in India under the name of *Pharbitisin*, has a nauseous acrid taste and an unpleasant odour, especially when heated. It melts at about 160° C. The following liquids dissolve it more or less freely, namely, spirit of wine, absolute alcohol, acetic acid, glacial acetic acid, acetone, acetic ether, methylic and amylic alcohol and alkaline solutions.

It is, on the other hand, insoluble in ether, benzol, chloroform, and sulphide of carbon. With concentrated sulphuric acid, it forms a brownish yellow solution, quickly assuming a violet hue. This reaction, however, requires a very small quantity of the powdered resin. If a solution of the resin in ammonia after having been kept a short time is acidulated, no precipitate is formed; but the solution is now capable of separating protoxide of copper from an alkaline solution of the tartrate which originally it did not alter. Heated with nitric acid, the resin affords *sebacic acid*.

"From these reactions of Kaladana resin, we are entitled to infer that it agrees with the resin of jalap or *Convolvulin*. To prepare it in quantity, it would probably be best to treat the seeds with common acetic acid, and to precipitate it by neutralising the solution. We have ascertained that the resin is not decomposed when digested with glacial acetic acid at 100° C., even for a week.

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"We have had the opportunity of examining a sample of Kaladana resin manufactured by Messrs. Rogers and Co., Chemists of Bombay and Poona, which we found to agree with that prepared by ourselves. It is a light yellowish friable mass, resembling purified jalap resin, and, like it, capable of being perfectly decolorised by treatment with animal charcoal." (*Op. cit.*, 2nd Ed., p. 449.)

Commerce.—Kaladana is collected in different parts of the country; the plant is everywhere common during the latter part of the rainy season.

In the Bombay market the seeds of *Ipomœa muricata*, Jacq., imported from Persia, are much more common than those of the true Kaladana. They are accepted by the natives as Kaladana. Value, Rs. 5 per maund of 37½ lbs.

IPOMÆA DIGITATA, *Linn.*

Fig.—*Rheede Hort. Mal. xi.*, 49; *Bot. Reg., t.* 62, *Bot. Mag*, 1790. Syn.—*Batatas paniculata.*

Hab.—Tropical India. The root.

Vernacular.—Bidári-kand, Bilái-kand (*Hind.*), Bhumi-kumra (*Beng.*), Bhui-kohola, Pattána (*Mar.*), Bhui-kohola (*Guz.*), Matti-pál-tiga (*Tel.*), Nela-gumbala, Buja-gumbala (*Can.*), Pál-modekka (*Mal.*), Nelli-kumbalu (*Tam.*).

History, Uses, &c.—This plant is mentioned by the early Sanskrit writers on medicine under the names of Vidári and Bhumi-kushmánda. In the Nighantas it bears numerous synonyms, such as Payas-vini, "abounding in milk"; Vriksha-valli, "tree-creeper"; Ikshu-valli and Kshira-vidári. The name Bhumi-kushmánda signifies "earth gourd," and is applied to *I. digitata*, from a supposed resemblance between its large tuberous root, and the gourd of *Benincasa cerifera*. The vernacular names Bhumi-kumra and Bhui-kohola have the same meaning; in Hindi Bilai signifies a "pumpkin scraper," and kand "a tuberous root," and in Malayalim pál signifies "a milky juice," and modekka "a gourd."

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The large tuberous root is considered tonic, alterative, aphrodisiac, demulcent, and lactagogue. In the emaciation of children with debility, and want of digestive power, the following diet is recommended :—"Take of Vidari, wheat flour and barley equal parts, and make into a confection with milk, clarified butter, sugar, and honey." Susruta gives several prescriptions for its use as an aphrodisiac. The simplest is as follows :—" Macerate the powder of the root in its own juice, and administer with honey and clarified butter. Vidari enters into the composition of several diuretic and demulcent mixtures."

In the Concan the root is peeled and cut in small pieces and dried in the shade, it is then powdered and the powder repeatedly moistened (14 times) with the juice of the fresh root and dried. Half a tolá of this preparation may be taken daily in honey or milk as an aphrodisiac. From this powder a *Paushtik* is made by frying it in butter with equal parts of almonds, quince seeds, cloves, cardamoms, nutmegs, satawari, gokhroo, seed of *Mucuna pruriens*, musli, &c., and making the whole into a conserve with sugar. This conserve is taken dissolved in milk in doses of half a tolá or more, as an aphrodisiac. In spermatorrhœa the juice is given with cumin and sugar, and as a lactagogue it is combined with coriander and fenugreek. Rheede says:—"Radix in sole siccata, trita, in pulverem redacta, cum saccharo et butyro decocta et assumpta, macilentos fertur reddere et obesos; sed et immodicum mensium sistit fluxum, et in febribus ossium confert."

Description.—The root is a simple or branched tuber, sometimes as much as 40 to 50 lbs. in weight, externally it is of a brown colour, and somewhat warty and scabrous. When a transverse section is made the cut surface is of a dirty white colour, and marked by concentric rings, which are formed by the vascular and laticiferous vessels; from the latter a viscid milky fluid exudes; the taste is astringent and somewhat acrid, not unlike raw potato. The bulk of the tuber consists of a starchy parenchyme. The vascular system is scalariform.

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The laticiferous vessels are most numerous towards the cortical part; raphides abound.

Chemical composition.— The fresh tuber, collected in November when the vine had died away, was sliced, dried at a low temperature and reduced to fine powder. The powder dried at 100°C., yielded 2·68 per cent. of extractive to absolute alcohol of which 1·73 per cent. was soluble in ether. The resins contained in the alcoholic extract had the properties of Jalap resins as regards colour, reactions, &c.; but we are unable to say whether they possess any purgative action. Sugar, reducing alkaline copper solution on boiling, was present to the extent of 10·909 per cent. calculated on the anhydrous tubers. The bulk of the tuber consists of starch. Supposing the resins to be purgative, they are present in so small a proportion that no ordinary dose of the root would have any aperient action.

IPOMÆA BILOBA, *Forsk.*

Fig.—*Rheede Hort. Mal. xi., t.* 57; *Bot. Reg.*, 319. Syn.—*I. pescapræ.* Goat'sfoot Convolvulus (*Eng.*).

Hab.—Coasts of India and Ceylon. The root and leaves.

Vernacular.—Dopátilata (*Hind.*), Chhágal-khuri (*Beng.*), Marjádvel (*Mar.*), Ravara-patri (*Guz.*), Balabandi-tiga, Chevulapilli-tiga (*Tel.*), Kutherai-kolapadi, Auttoo-kala-dumbo, Adapu-kodi (*Tam.*), Adambu-balli (*Can.*).

History, Uses, &c.—Vriddhadáraka is the name of a drug in use throughout India; it is a twisted root about half an inch in diameter, upon the broken or cut ends of which may be observed a black, concreted juice. It is supposed to strengthen the body and prevent the effects of age (Viddha dáraka). Dutt states that in Bengal the root of *Argyreia speciosa* is used, but the drug sold as Vardhára in Western India is not the root of this plant; it appears, however, to be obtained from a plant of the same order, but, as is usually the case in India, the herbalists will not indicate the source from which they obtain it. If we turn to the Nighantas we find the following synonyms for Vriddhadáraka:—Chhagala, Chhagalánghri, "goat's foot"; Chhagalándi, "goat's testicles;" Chhaggalántri, "goat's guts;" Antri, Raksho-ghna, Dirgha-mulaka, Anda-kotara-pushpi, Durga and Mahasyama. From these names it would appear that the "goat's foot convolvulus" is the plant which ought to be used. Vriddhadáraka is described as astringent, hot, pungent, alterative, tonic; a remover of rheumatism, dropsy, gonorrhœa and phlegm. These properties agree very nearly with those ascribed to *I. biloba*, the leaves of which boiled are applied externally in rheumatism and colic; whilst the juice is given as a diuretic in dropsy, and at the same time the bruised leaves are applied to the dropsical part. Rheede, speaking of *I. biloba*, which he calls *Schovanna Adambu*, states:—"In aqua decocta fomentum exhibet quo dolores arthritici mitigantur. Folia cum lacte caprarum in potionem præparata, pro hæmorrhoidibus propinantur."

According to P. S. Mootooswamy, the leaves are used as a cataplasm in phlegmon, &c. Plumier states that the dried juice of the root is used as a purgative in the Brazils in doses of 12 to 14 grains, and that it should be given like jalap resin with ginger and bitartrate of potash.

I. biloba is sacred to Durga, and the Kolis on the Western Coast, on the sixth day after a child is born, decorate its cradle with the flowers to propitiate that goddess, who, under the name of Shashti, is supposed to destroy newborn children. In this respect it also agrees with the description of Vriddhadáraka. The Brahminical name for the plant given by Rheede is बांगडीवली, a combination of the Marathi word Bángadi, "a coil of rope or bangle," and the Sanskrit Valli, "a creeper."

Description.—A perennial plant with a tough woody root of great length; it abounds in sandy ground near the sea-shore; from the enlarged crown of the root grow a number of creeping stems, fleshy and purplish when young, but becoming woody as they mature; the leaves are smooth, thick, long petioled, and two-lobed like those of the Bauhinias; the flowers large, and of a reddish purple. A section of the root shows in the central portion five wedge-shaped bundles of fibro-vascular tissue; external to these is a row of laticiferous vessels full of a viscid yellow latex, then again come a number of irregularly placed fibro-vascular bundles, and external to them another zone of laticiferous vessels. The parenchyme of the root contains starch and large conglomerate raphides. The whole plant is very mucilaginous.

Chemical composition.—The powdered roots, dried at a low temperature, were exhausted with 80 per cent. alcohol: the tincture exhibited a slight greenish yellow fluorescence. The tincture was freed from alcohol by spontaneous evaporation, and the extract mixed with water, acidulated with sulphuric acid and agitated with benzole. During agitation, a brownish soft resin separated; this resin was insoluble also in ether, but dissolved in alkalies with a dark yellowish brown coloration, and was precipitated by acid in brown flocks. The benzole solution left on spontaneous evaporation a viscid transparent residue of the colour and consistence of Venice turpentine, which possessed a slight odour of peppermint. This extract was soluble in absolute alcohol with greenish yellow fluorescence and was neutral in reaction: it was also soluble in ether, with similar fluorescence. The alcoholic solution gave with ferric chloride a dirty greenish precipitate. In cold 5 per cent. caustic soda it was insoluble, but on boiling it dissolved with some difficulty, affording a dark yellowish solution, while an odour not unlike that of aniseed was noticed. The cold caustic soda solution on agitation with ether afforded a small amount of yellowish white oily extractive with an odour of aniseed. The caustic soda solution on the addition of dilute acids afforded a yellowish precipitate. The original acid aqueous solution was next agitated with ether. The extractive was small in amount, partly in the form of a transparent varnish adhering to the sides of the capsule, and partly in indistinct whitish crystals. Heated with water, a portion dissolved, affording a clear solution, but which became turbid on cooling from a deposit of yellowish flocks, which on microscopic examination were not found to exhibit a crys-

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talline structure; we only detected minute globules. The aqueous solution was strongly acid in reaction, and gave with ferric chloride a dirty greenish coloration, with lime water a bright yellow coloration, and with basic acetate of lead a sulphur-yellow precipitate. This principle, soluble in water, and reprecipitated on cooling, is probably allied to the Quercitrin group of principles. That portion of the residue insoluble in water, was in properties similar to the resin dissolved by benzole.

The aqueous acid solution was lastly rendered alkaline and agitated with ether. The ethereal extract was not more than a trace, but afforded all the reactions in a marked degree of an alkaloidal principle.

The leaves also afforded marked evidence of the presence of an alkaloidal principle soluble in ether, and probably similar to the one we detected in the roots.

Several other species of *Ipomœa* are considered by the natives of India to have medicinal properties. **I. reniformis,** *Chois., Burm. Fl. Ind.* 77, *t.* 30, *f.* 1, is said to be deobstruent and diuretic; the juice is administered in rat-bite, and is supposed to cure sores in the ear. The plant is called Músha-karni, "rat's ear," in Sanskrit, from the resemblance of its leaves to the ear of that animal. The vernacular names Undirkáni, Mushkani, &c., have the same meaning. Its properties appear to us to be more fanciful than real, though, like others of the genus, it is purgative if taken in large doses.

Description.—Stem creeping and rooting; leaves kidney-shaped, waved, and dentate on the margin, obtuse; petioles hairy; peduncles very short, 1 to 2-flowered; corolla small, yellow. Common in places where water has lodged; flowers in the cold weather. At a little distance the plant has the appearance of *Hydrocotyle asiatica*.

I. vitifolia, *Sweet., Burm. Fl. Ind.* 45, *t.* 18, *f.* 1, is a large perennial climbing plant, with cordate, palmately 5-cleft leaves, and large, bright yellow flowers, the juice of which is considered to be very cooling, and is administered with milk and

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sugar; it is also applied locally to inflamed eyes, mixed with limejuice one part, opium ½, and Mámirán (Coptis root) ½.

I. Quamoclit, *Linn.*, *Rheede Hort. Mal. xi.*, *t.* 60, a small twining plant, easily recognised by its filiform, pectinate leaves, and small bright crimson or white flowers, is considered by the Hindus to have cooling properties; they apply the pounded leaves to bleeding piles, and at the same time administer one tolá of the juice with an equal quantity of hot *ghi* (clarified butter) twice a day internally. The crushed leaves are also applied as a *lép* (plaster) to carbuncles.

The Sanskrit name is Kámalata, "Cupid's flower." (See *As. Researches*, iv., p. 256.) The Marathas call it Sita-che-kes, "Sita's locks."

I. sinuata, *Ortega*, a native of Tropical America introduced in the North-West Provinces, is the "Noyeau Plant." The leaves have an odour of oil of bitter almonds, and are used in the preparation of the French Liqueur known by that name.

I. campanulata, *Linn.*, *Rheede Hort. Mal. xi.*, *t.* 56, is said to be an antidote to snake-poison.

I. sepiaria, *Koen.*, *Rheede Hort. Mal. xi.*, *t.* 53, has a reputation as an antidote to arsenic; the juice, which is strongly acid, is said by Rheede to be used "*ad purificationem corporis.*"

I. pes-tigridis, *Linn.*, *Rheede Hort. Mal. xi.*, *t.* 59, is supposed to be an antidote to the poison of mad dogs; pounded with butter, it is applied to disperse boils and carbuncles.

I. uniflora, *Roem. et Sch.*, *Rheede, Hort. Mal. xi.*, *t.* 54, is purgative, and the juice is administered in bilious dyspepsia.

I. aquatica, *Forsk.*, *Rheede, Hort. Mal. xi.*, *t.* 52, is commonly used as a vegetable. It is called Kalambi in Sanskrit, Kalmi-sák in Bengali, and Náli-chi-bhájí in Marathi.

I. bona-nox, *Linn.*, *Convolv. Or.* 59, *t.* 1, *f.* 4, is the Moon-flower.

The pericarpium of this species of Convolvulus contains usually four seeds about the size of kidney beans, which are eaten when young. Dried, these capsules and seeds, as well as the flowers, leaves and root, are amongst the medicines which are supposed to have virtues in snake-bites; the dose of the seeds is about three daily, administered in powder. (*Ainslie.*) The capsules have been sent to us from Poona as being in use there. In the Concan the juice of **Rivea ornata**, Phánd (*Mar.*), is made with Borneo camphor and butter into an ointment for pityriasis. For piles, one tolá of the juice with half a tolá of Babul pods, and a little sugar, is given in a quarter seer of cow's milk every morning.

ARGYREIA SPECIOSA, *Sweet.*

Fig.—*Wight Ic., t.* 851; *Bot. Mag.* 2446. Elephant-creeper (*Eng.*).

Hab.—Throughout India. The leaves and root.

Vernacular.—Samandar-sokh (*Hind.*), Bijtarka (*Beng.*), Samudra-shok (*Mar.*), Shamuddira-pachchai, Kadal-pála (*Tam.*), Samudra-pála, Kokkita (*Tel., Can*), Samudra-pachcha, Samudra-yogam (*Mal.*), Samudra-sosha (*Guz.*).

History, Uses, &c.—The root of this large climbing plan which is called Samudra-sosha in Sanskrit, is used as a substitute in Bengal for the drug described under the name of Vriddhadáraka, a drug which we have already noticed as having been originally the root of *Ipomœa biloba*. The large leaves, which have the under-surface covered by a thick layer of silky hairs, afford a kind of natural impermeable piline, and are used as a maturant by the natives. With regard to the alleged blistering properties of the upper surface of the leaf there must be some mistake, as we find it has no effect when applied to the skin.

Description.—Leaves heart-shaped, 9 to 12 inches long and 8 to 10 broad, or even larger; upper surface dark green and smooth, under-surface white and silky from the presence of a felted layer of long simple hairs. Under the microscope these are seen to be simple tubes gradually tapering to a point,

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and much like the fibre of flax; they are very strong and not easily removed by pulling or scraping; they retain moisture well.

The roots are long, woody and tough, covered with a dark brown bark; on transverse section they present a central porous woody column, and several concentric rings of woody fibre, between which are situated portions of parenchyma. In the woody portions of the root there are large laticiferous vessels which contain a yellowish latex. The vascular system consists of very large dotted vessels. In the parenchyme are numerous conglomerate raphides.

Chemical composition.—The roots yielded acid resins of an amber colour, soluble in ether and benzole, and partly soluble in alkalies. The acid ether extract was partly soluble in water with strong acid reaction, and gave with ferric salts a grass-green coloration; with alkalies a bright yellow. The portion insoluble in water was soluble in alkalies with orange coloration, and afforded with acids a yellowish-white precipitate. The original aqueous solution after addition of an alkali and agitation with ether, failed to afford any alkaloidal reactions when the ethereal extract was tested. This extract did not amount to more than a trace. The original aqueous solution contained a tannin-like principle.

CONVOLVULUS ARVENSIS, *Linn.*

Fig.—*Eng. Bot. v., t.* 312; *Bulliard Herb. Fr., t.* 269. Small Bindweed (*Eng.*), Liseron des champs (*Fr.*).

Hab.—Western India from Cashmere to the Deccan. Most temperate climates. The root.

Vernacular.—Hiranpad, Hiranpadi (*Hind.*), Hiranpag (*Guz., Sind.*), Naranji (*Can.*).

History, Uses, &c.—This common weed of cultivation is the *Helxine Cissampelos* of Matthiolus (*Valgr.* 2, 359). Helxine (ελξίνη) is a Greek name for a plant described by Dioscorides (iv. 37), and apparently of two different plants, mentioned by Pliny and Paulus Ægineta, which have not been satisfactorily identified. Roxburgh describes *C. arvensis* under the name of *C. Malcolmi*; his plant was raised from seeds brought from Persia by Major Malcolm in 1801. Stewart and Aitchison notice the occurrence of the plant in the Punjab. Dr. Gibson states that it is very common on the black soil of the Deccan, flowering during the rains. The root is used as a purgative in the Punjab and Sind.

Description.—Root perennial; stems and branchlets twining to an extent of six or eight feet, somewhat furrowed, twisted, and villous, herbaceous; leaves petioled, sagittate, margins a little hairy, smooth on both sides, from 1 to 3 inches long; barbs or posterior lobes dilated, spreading, somewhat acute, often dentate, and always angular; petioles scarcely half the length of the leaves, channelled; peduncles axillary, 2-flowered, three times longer than the petioles, round; pedicels clavate, as long as the petioles, villous; bracts two, opposite, at the base of the pedicels, lanceolate; calycine leaflets ovate; corol large, of a beautiful lively pink colour, margins almost entire; filaments not half the length of the corol, villous at the base; anthers purple; germ with a yellow ring round the base; style longer than the stamina; stigma of two linear, spreading lobes. (*Roxburgh.*)

Chemical composition.—This plant, like many others of the genus, contains convolvulin.

EVOLVULUS ALSINOIDES, *Linn.*

Fig.— *Lam. Ill., t.* 216, *f.* 2; *Wight Ill., t.* 168; *Rheede, Hort. Mal. xi., t.* 64.

Hab.—Throughout India and Ceylon. The herb.

Vernacular.—Vishnukránta (*Hind.*), Shankavéli (*Mar.*), Vistnukrandi (*Tam., Can.*), Vistnukrandum (*Tel.*).

History, Uses, &c.—This plant is the Vishnu-kránta, "Vishnu's step," of Sanskrit writers. In the Nighantas it bears the synonyms of Nila-pushpa, "blue flowered," Jaya and Parájita; it is described as bitter, cephalic, anthelmintic, anti-

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phlegmatic and antiphlogistic. In Vedic times it was thought to promote conception. At the present time it is thought to strengthen the brain and memory, and is used extensively as a febrifuge and tonic. Rheede calls it Vishnu-clandi, an evident corruption of the Sanskrit name; he states that it is used as a febrifuge with cumin and milk, also as an alterative, and with oil to promote the growth of the hair. According to Ainslie, the leaves, stalks, and roots are all used in medicine by the Tamools, and are supposed to possess virtues in certain bowel affections; they are prescribed in infusion in the quantity of half a teacupful twice daily. Burmann says that it is reputed to be a sovereign remedy for dysentery.

Description.—A very small herbaceous plant, cæspitose, procumbent, covered with adpressed hairs; leaves ovate-oblong, subsessile, less than ½ inch long; peduncles one-flowered, as long as the leaf or longer; flowers of a beautful deep blue, very small. Common everywhere in grassy places.

Chemical composition.—Ether separated from the powdered herb a yellow neutral fat of the consistence of vaseline. The alcoholic extract contained an alkaloid of a slightly bitter taste, and affording no colour reactions with strong mineral acids. An organic acid of a deep red brown colour occurred in the water extract, and formed an uncrystallizable compound with lead. A quantity of saline matter was present in this drug.

SAKMUNIYA or BAZAR SCAMMONY.

This substance is all fictitious, and is said to be made in Surat; nevertheless it was for many years purchased by the Medical Store Department in Bombay under the impression that it was genuine Scammony! (See *Pharmacopœia of India*, p. 447.) It usually occurs in irregular fragments of a bright green colour, somewhat translucent at the edges, and having a resinous fracture. Rectified spirit dissolves the resin, and leaves a residue of green colouring matter and gum; the former is evidently of vegetable origin.

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Sometimes a black Sakmuniya is met with; this is also spurious, and is resinous in taste and smell, but has a more earthy appearance than the green variety. Rectified spirit dissolves out a quantity of resin, and leaves a black residue which, under the microscope, is seen to be made up of tufts of vegetable hairs, numerous small carbonaceous particles, and small irregular crystalline particles. Treated with dilute hydrochloric acid it effervesces feebly after a short time; with strong acid it effervesces strongly at once, and forms a green solution.

The Persians call Scammony Mahmudah. Mir Muhammad Husain in the *Makhzan* gives a good description of it and the plant which produces it. He tells us that artificial Scammony is made from the juice of *Calotropis gigantea*, mixed with the flour of a kind of pulse called in Persian '*Karsanah*.' His account of the uses of the drug does not differ materially from that given in European works, with the exception that Scammony when baked is said to lose its aperient properties and to act as a powerful diuretic The baking process consists in enclosing the powdered drug in a bag, and then placing the bag inside an apple or quince which has been hollowed out for the purpose, the apple is then enclosed in dough like a dumpling and baked in an oven.

CRESSA CRETICA, *Linn.*

Fig.—*Lam. Ill.*, *t.* 183; *Sibth. Fl. Græc.*, *t.* 256.

Hab.—Throughout India. Common on the West Coast.

Vernacular.—Rudravanti, Rudranti (*Hind.*, *Beng.*), Khardi, Chavel (*Mar.*), Una (*Guz.*, *Sind.*).

History, Uses, &c.—This plant is the Rudantika and Amrita-srava of Sanskrit writers, and is believed to exude moisture, since the ground in its neighbourhood is always moist, and ants are always to be found near it. Medicinally it is considered to be exhilarating, and to purify the blood and give tone to the system. It is prescribed in decoction as a tonic, and is believed to possess expectorant and antibilious properties.

C. cretica is found in Greece, and is supposed to be the first kind of ἀνθυλλὶς mentioned by Dioscorides (iii., 144); it is described as growing in sandy ground, and having a salt taste, and was used as a diuretic and to disperse swelling and phlegmatic humors. Paulus Ægineta and Pliny also mention it. Mahometan physicians copy what the Greeks have said about the two kinds of anthyllis, but give no Arabic or Persian name for the drug, and those who have written in India do not identify it with the Rudantika of the Hindus. It appears to retain its place in their Materia Medica solely because of its repute among the Greeks.

Description.—A very small, shrubby, diffuse plant; leaves ovate, sessile, very small, acute, numerous, ashy or hoary-pubescent; flowers small, white or pink, sub-sessile, in the superior axils, forming a many-flowered head. It is very common in rice fields about Bombay in the cold weather, and is much used by gardeners for making bouquets. The plant has a bitter and saline taste. According to Retz and Roxburgh the Indian plant differs from the common form of *C. cretica* in having 4 seeds.

Chemical composition.—The plant contains an alkaloid soluble in ether, which fails to afford any special colour reactions; its solution is not precipitated by chromates. It is not bitter. There is nothing else in the plant of special interest.

AFTIMUN.

This is the Arabic form of the Greek word ἐπιθύμον, "growing on thyme," a name applied by Dioscorides to a plant growing in Cappidocia and Pamphylia, which was used for purging the body of pituitous humors and black bile (iv. 172). His description of it is so unsatisfactory that it is doubtful whether

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he is speaking of the flowers of a kind of thyme, or of a parasitic plant growing on thyme. Pliny (26, 35), commences by speaking of *Epithymon* as the blossom of a sort of thyme similar to Savory, but ends by saying—"Some persons, again, give a different description of epithymon: according to them, it is a plant without a root, diminutive, and bearing a flower resembling a small hood, and of a red colour." Epithymon is generally identified with *Cuscuta Epithymum*, Linn., the Lesser Dodder, a parasitic plant upon Heath, Furze, Thyme and other small shrubby plants. (See *Fl. Br.* 283: *Fl. Dan. t.* 427.) The plant used medicinally in India as *Aftimun* is imported from Persia, and appears to be a larger species, probably *C. europea*, Linn., which is a native of Europe and of Western and Central Asia. Mahometan physicians consider this drug to be alterative and depurative, a purge for bile and black bile, useful in all affections of the brain such as fits, melancholy, insanity, &c. They also describe it as carminative; and apply it locally as an anodyne. The author of the *Makhzan-el-Adwiya* devotes a whole folio page of small print to a description of its properties and uses. In modern medicine the different species of Cuscuta are no longer used.

Chemical composition.—In addition to quercetin, which was present in large amount, and resins, an alkaloidal principle was isolated, slightly bitter, soluble in ether, but more easily dissolved by chloroform. This alkaloid did not afford any special colour reactions. We provisionally call it *Cuscutine*.

KUSHOOTH, *vulg.* KASOOS.

Kushooth (كشوث) is the Arabic name for the Dodders, and from it have been derived the Greek *κασσυθα* and Latin Cuscuta of mediæval writers.

An Arabian poet says:—

هو الكشوث فلا اصل ولا ورق ∴
ولا نسيم ولا ظل ولا ثمر ∴

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"He is like the Kashooth; for he has neither root, leaves, fragrance, shade or fruit."

In the Indian bazars the name is applied to the fruit of a species of Cuscuta, imported from Persia, and also called *Tukm-i-kasús*; it is mixed with the small oblong leaves and spines of the plant upon which it has grown, and the flowers and portions of the stem may often be found. The seeds are four in number, light brown, convex on one side, concave on the other, and enclosed in a nearly globular capsule about the size of a radish seed. The taste is bitter. Mir Muhammad Husain identifies this drug with the *Amal-bel*, *Akús-bel*, or *Amarlata* of India, and describes it as yellow, growing on thorns and other shrubs, and as having a very small, whitish flower, and seeds rather smaller than radish seeds, nearly round, and of a reddish yellow colour. Its properties are described as much the same as those of Aftimun. The plant may be either *C. hyalina*, Roth., *C. chinensis*, Lam., or *C. planiflora*, Tenore; possibly several species are collected. In India *C. reflexa*, Roxb., is sometimes used; it is a larger plant, and has larger fruit than the imported article.

Chemical composition.—In addition to quercitrin, we separated a bitter and glucosidal resin, insoluble in ether, but soluble in amylic alcohol, and also somewhat soluble in water. With basic acetate of lead, after the solution of the resin in alkalies, a light yellow precipitate was afforded; but when the alkaline solution was exposed to air, the precipitate with basic lead was of the colour of chromate of silver. An alkaloidal principle was also present in traces which failed to give any special colour reactions. The presence of a principle in traces possessing a marked rhubarb-like odour was detected; this principle did not appear to exist ready formed in the seeds, but was a product of the action of dilute acids on an undetermined principle: it was soluble in ether and benzole. Astringent matter affording a plum-coloured precipitate with basic acetate of lead was also present; as well as wax, and a certain amount of oil.

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SOLANACEÆ.

SOLANUM NIGRUM, *Linn.*

Fig.—*Wight Ic. t.* 344; *Jacq. Pl. Rar. ii., t.* 326; *Rheede, Hort. Mal. x., t.* 73. Garden Nightshade (*Eng.*), Morelle noire (*Fr.*).

Hab.—Throughout India and Ceylon. All temperate and tropical parts of the world. The herb in fruit.

SOLANUM DULCAMARA, *Linn.*

Fig.—*Bentl. and Trim. t.* 190. Bitter-sweet Nightshade (*Eng.*), Douce amère, Vigne vierge (*Fr.*).

Hab.—Temperate W. Himalaya, Europe, Central Asia. The herb in fruit.

Vernacular.—*S. nigrum*: Makoi, Gúrkamai (*Hind.*), Kák-máchi (*Beng.*), Kámuni (*Mar.*), Pilúdu (*Guz.*), Manatta-káli (*Tam., Mal.*), Kánchi-chettu, Kámanchi-chettu (*Tel.*), Kánchi, Ganikè (*Can.*). *S. dulcamara*: Inab-es-sálib (*Ind. Bazars*).

History, Uses, &c.—The Sanskrit names Káka-máchi, Kákamáta, Dhvánksha-máchi, Jaghana-phala and Kinkini are probably applicable to both of these plants; whilst the vernacular names, with the exception perhaps of the Hindi, are only applicable to *S. nigrum*. In the Nighantas the drug is described as emollient, hot, sweet, strengthening, cardiacal and alterative; a useful remedy in dropsy, skin diseases, piles, fever, gonorrhœa, and inflammatory swellings. In a preparation called *Hridayarnavarasa* it is combined with mercury and sulphide of copper as a remedy in heart disease. In India at the present time *S. nigrum* is in general repute as a remedy for skin diseases, and as a local application to rheumatic and gouty joints. It is also valued as a diuretic. Under the name στρύχνος or τρυχνος the Greek physicians describe several Solanaceous plants, one of which, the στρύχνος κηπαῖος or

"Garden nightshade" of Dioscorides (iv. 69) appears to agree well with *S. nigrum*. He distinctly states that it may be eaten without danger, and describes it as very cooling whether applied externally or administered internally. It appears to have been used chiefly by the Greeks as a local application to inflamed parts.

Haji Zein-el-Attár, under the name of Inab-eth-thálib, "fox's grapes," in Persian Rúbah-turbak, and Sag-angur "dog's grapes," describes a kind of nightshade with yellowish red berries having similar properties, which he also says is useful in dropsy as a diuretic; he concludes with a caution against the use of another kind with black berries which causes delirium and is highly poisonous. In cases of poisoning by the latter plant he directs an emetic to be administered, and milk, or honey and water with aniseed and bitter almonds to be given. Most Arabian and Persian writers on Materia Medica describe the four kinds of στρύχνος mentioned by Dioscorides as varieties of Inab-eth-thalib, and copy from Greek writers, but they only appear to have used the first and second kinds medicinally, viz., *Solanum nigrum* or *dulcamara*, and *Physalis Alkekengi*, commonly known as Kákanaj. The Inab-eth-thálib of the present day, imported from Persia, consists entirely of the red berries of *S. dulcamara*. In India the juice of *S. nigrum* is given in doses of from 6 to 8 ounces in the treatment of chronic enlargements of the liver, and is considered a valuable alterative and diuretic. The juice after expression is warmed in an earthen vessel until it loses its green colour and becomes reddish brown; when cool it is strained and administered in the morning. It is said to act as a hydrogogue cathartic and diuretic. Mr. M. Sheriff in his Supplement to the *Pharmacopœia of India* speaks very favourably of it when used in this way. In smaller doses (1 to 2 ozs.) it is a valuable alterative in chronic skin diseases, such as psoriasis. In the Concan the young shoots are cooked as a vegetable and given in these diseases. Dr. D. B. Master of Bombay informs us that he has seen them used with great success in psoriasis. Loureiro states that the herb is anodyne, and should be used with caution; he notices its use externally to allay pain. The

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physiological action of *solanine*, the active principle of this plant, has been investigated by Max Perles (*Centralbl. f. Klin. Med.* 1890, No. 2), who found its action upon amœboids, infusoria and ciliated epithelium cells to be that of a powerful protoplasmic poison. A solution containing less than 1 per cent. prevented the growth of bacteria; a very dilute solution added to blood accelerated coagulation, whilst a stronger solution (1 per cent.) prevented coagulation and partially dissolved the red corpuscles; left for some hours in contact with hæmoglobin it converted it into reduced hæmoglobin, but not into methæmoglobin. In cold-blooded animals solanine produced paralysis of the central nervous system, acting first on the brain and afterwards on the spinal cord, and finally paralysing the heart muscle. Locally applied solanine produced destructive changes in muscular tissue, causing paralysis and obliteration of transverse striation, while the nerves, which were at first excited, finally became paralysed.

Intravenous injections of solanine in warm-blooded animals caused violent tremblings, soon followed by clonic spasms of the muscles of the jaw, nape of the neck and back, and afterwards by paralysis of the central nervous system.

The temperature changes in poisoning by solanine were found to indicate very exactly the gravity of the case, the minimum of temperature corresponding with the maximum of danger. The dyspnœa which was observed in all the cases is attributable partly to the disturbance of the circulation and partly to the blood changes which have been already noticed.

The *post-mortem* examination of animals poisoned by solanine showed a condition similar to the enteritis of typhoid fever, with here and there hæmorrhagic extravasations into the intestinal walls. The kidneys presented lesions similar to those seen in acute nephritis, with infarction of the renal tubes.

Intra-peritoneal injections of solanine caused hæmorrhagic peritonitis with exudation.

Moderate subcutaneous injections produced little effect, but if insufficient in quantity to be poisonous, the symptoms already

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described were observed, and the temperature fell as low as 31°·5 C.

The fatal dose of solanine administered by the stomach is ·30 gram. per kilo body weight; death takes place in 12 hours.

In dogs injections into the stomach cause violent vomiting, which interferes with the absorption of the poison.

Solanidine has similar properties, but is much less active than solanine; it has no local irritant action. The author classes these substances with the sapotoxins, such as quillaic acid, sapotoxin, senegin, cyclamin, &c.

Description.— *S. nigrum* is an erect annual or biennial, stem angled, with spreading or diffuse branches, one to three feet high, glabrous, or pubescent, with simple hairs, without prickles, but the angles of the stem sometimes raised and smooth or rough, with prominent tubercles; leaves petiolate, ovate-oblong, attenuated at both ends, 1 to 3 inches long, entire or repandly toothed; flowers small and white, in little cymes, contracted into umbels on a common peduncle, from very short to nearly an inch long; calyx 5-toothed or lobed to the middle; corolla deeply lobed, 3 to 4 lines in diameter; anthers very obtuse and short, opening in terminal slits, which are often continued down the sides; berry small, globular, usually nearly black, but sometimes yellow or dingy red.

S. dulcamara is a woody scandent plant, with numerous glabrous or sparingly pubescent branches, leaves ovate or oblong, subentire, lobed or lyrate, peduncles extra-axillary; cymes laxly panicled; calyx-teeth small, obtuse; corolla purple. The berries are $\frac{1}{4}$ inch in diameter, globose, red; seeds numerous, $\frac{1}{16}$ inch in diameter, smooth. The fresh plant has a fetid odour, which it loses when dried. Taste at first bitter, afterwards sweetish.

Chemical composition.— The most important constituent of *S. nigrum* is *Solanine,* which was discovered in the berries by Desfosses in 1821. This base has been represented by various formulæ. Zwenger and Kind's analyses lead to the formula

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$C^{43}H^{71}NO^{16}$; according to Kletzinsky it is $C^{21}H^{35}NO^{7}$. A. Hilger from recent analyses assigns to it the formula $C^{42}H^{87}NO^{15}$, and to *Solanidine*, obtained from it by boiling with dilute acids, the formula $C^{26}H^{41}NO^{2}$, while Zwenger and Kind assign to solanidine the formula $C^{25}H^{41}NO$ and represent its formation as being due to the assimilation of $3OH^{2}$ by solanine, and its resolution into solanidine and 3 molecules of glucose. Solanine forms delicate colourless, silky needles, appearing under the microscope as four-sided rectangular prisms. (Zwenger and Kind; Payen and Chevallier.) It turns yellow when heated, and melts at 235° C. (Zwenger and Kind.) It is inodorous and tastes faintly bitter and somewhat acrid. (*Gmelin Handb.* xviii. 90; *Watt, Dict. of Chem.* viii. 1807.) M. E. Wotezal (1890) has published an elaborate paper on the *Distribution of Solanine and its Microchemical Reactions* in Russian, from which we extract the following:—

"Solanine was found in nine species of *Solanum* and three of *Scopolia*. In the tubers it is found chiefly in the neighbourhood of the 'eyes.' In the vegetative portions it occurs in greatest abundance in the young tissues, and in the mature tissues it is usually entirely wanting except in the neighbourhood of the buds, and of the origin of the roots. In the floral organs the reverse is the case, the quantity of solanine increasing for a time in both calyx and corolla as the flower opens, but ultimately disappearing from these organs, while it continues to increase in the green unripe fruit, diminishing again when the fruit is ripe, and being then localized chiefly in the peripheral layers. The seat of the solanine is the cell cavity, where it occurs in the form of a soluble salt, and from which also it penetrates the cell wall by diffusion.

The author regards solanine as a product neither of primary synthesis nor of disorganization, nor as a secretion or excretion, nor as a reserve substance, nor as a transporting form like asparagin, but as an intermediate stage in the series of chemical changes which the already forward plastic substances undergo in the living cell. In the flowers and unripe fruits it undoubtedly also serves as a protection against consumption by animals.

Wotczal finds only three trustworthy tests for the presence of solanine, *viz.*:—(1) Mandalin's vanadin-sulphuric acid, *i.e.*, 1 part of ammonia-metavanadinate in 1000 parts of tri-hydrated sulphuric acid ($H^2SO^4+2H^2O$). The test is one of extraordinary delicacy; if the preparation contain solanine, it goes through the following series of colours:—yellow, orange-red, purple-red, brown, pure red, violet, blue-green, and then disappears altogether. (2) Brandt's reagent: 0·3 gram sodium selenate in a mixture of 8 c.c. of water and 6 c.c. of pure sulphuric acid. If the preparation containing solanine is first warmed, then, on cooling, it becomes first violet-red, then orange-red and yellow-brown, the colour finally disappearing. (3) Pure sulphuric acid as a macro-chemical reagent, but this test has no advantage over the other two. (*Pharm. Journ., July* 1890.)

Prof. E. Schmidt and Mr. Schütte (*Apoth. Ztg.*, 1890, 501,) have recently reported that they have found small quantities of an alkaloid having the property of dilating the pupil in *S nigrum*. Solanine has also been obtained from *S. dulcamara* along with a glucoside *Dulcamarin*. *Dulcamarine* was the name given by Wittstein to a nitrogenous substance which he obtained from the stalks of *S. dulcamara*. This substance has been further examined by Geissler (*Arch. Pharm.* (3) vii. 289), who, by treating it with ammonia, has freed it from a nitrogenous impurity, and by converting the remaining substance into a lead compound, and decomposing the latter with hydrogen sulphide, has obtained a pure non-azotised body having the composition $C^{22}H^{34}O^{10}$. This dulcamarin is amorphous, tastes bitter at first, afterwards persistently sweet dissolves in alcohol and acetic ether, and is precipitated by basic lead acetate, yielding the compounds $C^{22}H^{32}PbO^{10}+3H^2O$ and $C^{22}H^{32}PbO^{10}+5H^2O$.

By the action of dilute acids, dulcamarin is resolved into glucose and a resinous compound $C^{16}H^{26}O^6$, called *dulcamaretin*. (*Watt, Dict. of Chem.* viii. 694.)

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Toxicology.—Cases of poisoning from eating the berries of *S. dulcamara*, *S. nigrum*, and *S. tuberosum* (the potato) have occasionally been recorded in Europe, and it is also on record that the germinating tubers of the potato, have given rise to symptoms of poisoning. It would appear, however, that the process of cooking renders all those plants innocuous, or nearly so, as the herb of *S. nigrum* is used in India as a vegetable. Burton Brown (*Punjab Poisons*) records the death of three children after eating the berries of *S. nigrum*; the symptoms observed were, a feeling of sickness followed by vomiting, pain in the belly and intense thirst, pupils dilated, with impaired vision, headache, giddiness, delirium, purging and convulsions, sleep ending in coma.

Commerce.—The dried fruit of *S. dulcamara*, known as Anab-es-sálib in Bombay, comes from Persia. Value, Re. ¼ per lb.

S. nigrum is a common weed everywhere on cultivated ground. The dried fruit is met with in the shops in many parts of the country.

SOLANUM INDICUM, *Linn.*

Fig.—*Wight Ic.*, *t.* 346; *Rheede, Hort. Mal. ii.*, *t.* 36.

Hab.—Throughout India. The fruit and root.

Vernacular.—Bari-khatái, Birhatta, Barhanta (*Hind.*), Byakura (*Beng.*), Dorli, Mothi-ringani (*Mar.*), Ubhi-ringan (*Guz.*), Mulli, Pappara-mulli (*Tam.*), Tellamulaka (*Tel.*), Cheruchunta (*Mal.*), Gulla (*Can.*).

History, Uses, &c.—This plant is of importance in Hindu medicine as the source of one of the drugs required for the preparation of the Dasamula Kvatha. In the Nighantas it bears the Sanskrit names of Bhantaki, Vrihati, Mahati, "large egg plant," Vártáki, Mahotika, &c.; and is described as cardiacal, aphrodisiacal, astringent, carminative and resolvent; useful in asthma, cough, chronic febrile affections, colic, flatulence, worms, &c. The author of the *Makhzan-el-adwiya* notices it under the name of Birhatta, and repeats what the Hindu writers say about it. Chakradatta gives the following prescription as useful in bronchitis with fever: Take of the roots of *S. indicum*, *S. xanthocarpum*, *Sida cordifolia*, and *Justicia Adhatoda* one part, raisins one part, and prepare a decoction in the usual manner. Rheede notices its use in Malabar, and Ainslie (ii., 207) remarks that the root has little sensible taste or smell, but is amongst the medicines which are prescribed in cases of dysuria and ischuria in decoction to the quantity of half a teacupful twice daily. He also notices that Horsfield in his account of Java medicinal plants says, that the root taken internally, possesses strongly exciting qualities, and that Rumphius states that it is employed in difficult parturition. The berries, which are bitter, are sometimes cooked and eaten by the natives of India as a vegetable.

Description.—Trunk trifling, but the branches are numerous, ligneous, and perennial, forming a large, very ramous shrub of several feet in height, armed with numerous, very acute, somewhat recurved spines, the young parts are downy; leaves solitary, or in pairs, petioled, ovate-lobate, downy, and armed with a few straight spines on both sides, from 2 to 4 inches long; racemes between, or opposite to the leaves, supporting several long-pedicelled, middle-sized, pale blue flowers; calyx deeply 5-cleft, armed; berries erect, round, smooth, size of a marrowfat pea; while immature variegated with deeper and lighter green; when ripe, with deep orange yellow. (*Roxb.*)

Chemical composition.—200 grams of the fruits were found to consist of 58 grams of pericarps and 142 grams of seeds. These were powdered and examined separately, and had the following composition—

	Pericarps.	Seeds.
Ethereal extract	·9	13·5
Alcoholic ,, ...	5·8	10·1
Aqueous ,, ...	13·8	22·9
Mineral matter	11·2	7·7

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The pericarps contained a yellow wax-like principle melting at 45°, a trace of an alkaloid answering to solanine, and a quantity of ammonia combined as an ammonium salt. The seeds afforded 13·5 per cent. of a yellow oil having a specific gravity of ·9273. After saponification of the oil by alcoholic potash, the free fatty acids were liberated and found to consist mainly of oleic acid, and on standing in a cool place for several days, some white crystals separated out, having a melting point approximating that of myristic acid. An alkaloid was present in the seeds which could not be referred satisfactorily to solanine, and it was associated with a glucosidal principle giving a purple-coloured solution with sulphuric acid. The seeds like the pericarps contained an ammonium salt, and both portions of the fruit gave off strongly alkaline fumes on burning, and in which ammonia was easily detected. The fruits when dried and kept for some time are almost tasteless compared with their bitterness and acridity when fresh, and it would consequently appear that the alkaloids solanine and solanidine, become decomposed with the production of ammonia and other substances.

SOLANUM XANTHOCARPUM, *Schrad. et Wendl.*

Fig.—*Schrad. et Wendl. Sert. Hanov.* i. 8, *t.* 2; *Jacq. Ic. Rar.* ii., *t.* 332; *Wight Ic.*, *t.* 1401. Syn.—*S. Jacquini.*

Hab.—Throughout India. The plant.

Vernacular.—Laghu-khatái, Bhatkatya, Bhumi-ringani (*Hind.*), Kántakári (*Beng.*), Bhui-ringani, Kánte-ringani (*Mar.*), Patha-ringani (*Guz.*), Kandan-kattiri (*Tam.*), Vákudu, Nelamulaka (*Tel.*), Nelagulla (*Can.*), Kantam-kattiri (*Mal.*).

History, Uses, &c.—This plant is of importance in Hindu medicine, as its root is one of the *Dasamula* or "ten roots" so often prescribed in decoction by their physicians. (See *Tribulus terrestris.*) In the Nighantas it is called Kantakára and Kantakini, "thorny"; Nidigdhika, "clinging"; Vyághri, "tigress"; and Dush-pradarshani, "which cannot

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be touched"; and is described as aperient, pungent, bitter, digestive, diuretic, alterative, astringent and anthelmintic; useful in fever, cough, asthma, flatulence, costiveness and heart disease. It is also thought to promote conception in the female. In practice the drug is generally combined with other expectorants, demulcents and aromatics.

The following prescription from the Bhavaprakasha is quoted in "Dutt's Hindu Materia Medica":—*Kantakáryavaleha*, or electuary of *S. Jacquini*. Take of Kantákári 12½ seers, water 64 seers, boil till reduced to one-fourth and strain. Boil the strained decoction till reduced to the consistence of a fluid extract, and add to it the following substances in fine powder, namely, *Tinospora cordifolia, Piper Chaba, Plumbago zeylanica, Cyperus rotundus, Rhus Kakrasingi*, long pepper, black pepper, ginger, *Alhagi maurorum, Clerodendron Siphonanthus, Vanda Roxburghii*, and Zedoary root, each 8 tolás, sugar 2½ seers, sesamum oil and clarified butter each one seer. Boil together until reduced to the proper consistence. Lastly, add honey one seer, bamboo manna and long pepper in fine powder each half a seer.

This electuary is given to allay cough. The drug is also used in decoction with long pepper and honey, and with salt and asafœtida for asthma.

Mahometan writers, under the Arabic name of Hadak, or the Persian Bádinján-i-barrí (wild egg plant), mention three kinds of Solanum, having somewhat similar properties. Their small kind, or Hejazi, appears to be the *Solanum xanthocarpum*, which they recommend in asthma, cough, dysuria, catarrhal fever, leprosy, costiveness and stone in the bladder. Under the name of *Cundunghatrievayr*, Ainslie (ii. 90) notices the use of this drug in Southern India as an expectorant. The stems, flowers, and fruit, according to Dr. Wilson (*Calcutta Med. Phys. Trans.*, Vol. II., p. 406), are bitter and carminative, and are prescribed in those forms of Ignipeditis, which are attended with a vesicular, watery eruption. Fumigations with the vapour of the burning seeds of this plant are in high repute

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in the cure of toothache; they are smoked in a *chilam* like tobacco and the natives have the idea that the smoke kills the insects which they suppose cause the pain. The ancients used the seeds of Henbane in the same way. (*Scrib. Comp.* 54.) They act as a powerful sialogogue, and thus afford relief. (*Phar. of India, p.* 181.) In the Concan 2 tolas of the juice of the fresh plant, with 2 tolas of Hemidesmus juice, are given in whey as a diuretic, and the root with chiretta and ginger is given in decoction as a febrifuge. Dr. Peters, of the Bombay Medical Service, informs us that in Bengal the plant is much used as a diuretic in dropsy.

Description.—Root at least biennial; stem none, but several flexuose, ramous branches, spreading close on the ground, for an extent of some feet, often striking root at the insertion of the leaves; angular, nearly void of pubescence; leaves frequently in pairs, oblong, pinnatifid, or laciniate, smooth, but armed on both sides with long, strong, straight spines; racemes between the leaves, and almost as long, bearing 4 to 6 alternate, pedicelled, large, bright blue flowers; calyx armed with straight spines; berries spherical, size of a large gooseberry, very smooth, drooping, while immature variegated with green and white, when ripe with different shades of yellow only.—(*Roxb.*)

Chemical composition.—The fruits of this plant were found on analysis to have a similar composition to those of the previous article, except that in this case the fruits were examined in a fresh condition, and the solanine reactions of the alkaloid and the almost entire absence of ammonia were noticed. The dried leaves left 20·74 per cent. of ash when burnt, and contained traces of an alkaloid, and an astringent organic acid giving a green precipitate with ferric salts.

S. trilobatum, *Linn., Wight Ic. t.* 854, is mentioned by Ainslie as being used medicinally in Southern India. He says:—"The root, leaves and tender shoots of this creeper, are all used in medicine by the Tamools; the two first, which are bitter, are occasionally prescribed in consumptive cases in the form of electuary, decoction, or powder; of the electuary a teaspoonful and a half are given twice daily." (*Mat Ind.* ii., 427.) It appears to be used as a substitute for *S. xanthocarpum*. The medicinal use of **S. verbascifolium, S. torvum** and **S. ferox** has also been recorded, and it seems probable that these Nightshades are often mistaken by ignorant people for the officinal plants.

PHYSALIS ALKEKENGI, *Linn.*

Winter Cherry (*Eng.*), Coqueret, Coquerelle (*Fr.*).

Hab.—Persia, Southern Europe. The fruit.

Vernacular.—Káknaj (*Arab., Ind. Bazars*).

History, Uses, &c.—This plant appears to be the στρύχνος ἁλικακάβὸς of the Greeks, which they also called φυσαλὶς or φυσαλλις, and the Vesicaria or Halicacabus of the Romans; it was supposed to cure diseases of the bladder. It is the Kákanah of the Persians and Kákanaj of the Arabs. It also bears the names of Kachuman, and Arúsak-pas-i-pardah, or "bride behind the curtain," in Persia; the Sanskrit name is said to be Rájaputrika.

Abu Hanifeh, author of the *Book of Plants*, says of Káka-naj:—"It is of the Aghaláth and is a plant resembling the Harmal (*Peganum Harmala*), except that it is taller, with round branches, and having capsules (سنفم) like those of Harmal; it has also berries intensely red, like beads of cornelian, smaller than the Nabik (*Zizyphus Spina-Christi*) and larger than the currant, and people seek out the leaves thereof that have not been rendered foraminous, which leaves are then bruised and used beneficially as a dressing for maladies attended with pain." Other names for the fruit are Jouz-el-marj and Habb-el-lahv, which indicate that they are thought to be possessed of intoxicating properties.

Mahometan physicians describe it as diuretic, alterative and anthelmintic: and recommend it in skin diseases, rheumatism, jaundice and urinary affections. It is said to prevent conception if given to women after menstruation. Large doses are thought to be narcotic. Externally it is applied to promote the absorption of tumours, boils, carbuncles, &c. Laville's gout pills consist of 15 parts of extract of Alkekengi and 5 parts of silicate of soda. Four to ten 5-grain pills are taken daily.

Description.—The fruit is about the size, shape and colour of a small dried cherry, skin smooth and shining, reddish brown, much shrivelled; it contains a large number of flattened, reniform seeds of a light brown colour, and smaller than those of *Withania coagulans*; these are sticky from the presence of a small quantity of brown pulp, which has a fruity odour.

Chemical composition.—Dessaignes and Chautard (*N. J. Pharm.* 21, 24) found sugar and citric acid in the berries, and in the leaves and calyx an amorphous bitter principle, *Physalin*, $C^{14}H^{16}O^{5}$, which is obtained as a whitish powder on agitating the cold aqueous infusion with chloroform, and is soluble in alcohol, but sparingly so in ether, cold water and diluted acids. (*Gmelin, Handb. xvi.*, 191.)

PHYSALIS MINIMA, *Linn.*

Fig.—*Rheede Hort. Mal. x. tt.* 70, 71.

Hab.—Throughout India. The plant in fruit.

Vernacular.—Tulati-pati (*Hind.*), Káknaj (*Punj.*), Ban-tepariya, Tekári (*Beng.*), Thánmori, Chirbutli, Chirboti (*Mar.*), Kupanti (*Tel.*), Bondula (*Can.*).

History, Uses, &c.—This common weed of cultivation, called in Sanskrit *Tankári*, occurs in two forms, one with a berry about the size of a pea and the other with a berry half an inch in diameter. The former plant is pubescent and the latter glabrous. Tankári is considered by the Hindus to be tonic, diuretic and aperient, and is an ingredient in a medicinal oil which is given for enlargement of the spleen; the other ingredients are Pokharmul, Hing, Hirda, Long pepper, Bit

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(black salt), Saindhava (rock salt), Javakshara (potash), ginger and melted butter. In the Concan the plant is made into a paste with rice water, and applied to restore flaccid breasts, in accordance with the doctrine of signatures. Both varieties of this plant are noticed by Rheede, and Ainslie (ii. 15) in a note remarks that *P. minima* has been noticed by Dr. Heyne as medicinal among the Hindus, and is called by them Lakshmi-devatya, "sacred to Lakshmi." Dr. Stewart states that the fruit is considered in the Punjab to be tonic, diuretic and purgative. It is used by the Mahometans as a substitute for *P. Alkekengi*.

Description.— An herbaceous annual, leaves 2 inches; petiole 1 inch; pedicels $\frac{1}{4}$ to $\frac{1}{2}$ inch; calyx at flower-time $\frac{1}{8}$ to $\frac{1}{6}$ inch; lobes lanceolate, half the length of the calyx, often hirsute, sometimes glabrescent; corolla clear yellow or sometimes spotted at the base; berry nearly globular; fruit-calyx globose in the smaller variety, 5-angular in the larger, 5 or 10-ribbed; seeds numerous, $\frac{1}{12}$ inch, discoid, reticulated, scarcely scabrous.

P. peruviana, the Cape Gooseberry, or Brazil Cherry, which is cultivated in India, hardly differs from this plant except in its larger size and more oblong berry. It affords an excellent fruit, and is now much cultivated in France and is largely used in India for making the well known "Topare jam."

CAPSICUM FRUTESCENS, *Linn.*

Fig.—*Lam. Ill.*, *t.* 116, *f.* 1; *Rheede, Hort. Mal. ii.*, *t.* 56. Chillie (*Eng.*), Piment de Cayenne (*Fr.*).

Hab.—America. Cultivated throughout India. The fruit.

CAPSICUM MINIMUM, *Roxb.*

Fig.—*Wight Ic. t.* 1617; *Bentl. and Trim.*, *t.* 188. Bird's-eye Chillie (*Eng.*), Piment de l'île Maurice (*Fr.*).

Hab.—Uncertain. Cultivated in India. The fruit.

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Vernacular.—Mirch, Lal-mirch, Gách-mirch (*Hind.*), Mirchi, Tambari-mirchi, Mir-singha (*Mar.*), Milagay (*Tam.*), Mirapakáya (*Tel.*), Kappal-melaka (*Mal.*), Menashina-káya (*Can.*), Lál-morich, Lanka-morich (*Beng.*), Làl-mirch, Marchu (*Guz.*).

History, Uses, &c.—Clusius states that Capsicums were brought to India from Pernambuco by the Portuguese; from India they were introduced into Germany, and finally reached England in 1595. The Spaniards were acquainted with the spice as early as 1494. Chanca, physician to the fleet of Columbus in his second voyage to the West Indies, notices them among the productions of Hispaniola as a condiment used by the natives under the name of *Agi*, which is still the common name for them in Spanish. In English they were formerly known as Guinea-pepper, and the Portuguese call them Pimenta de Guiné. Chili is the Mexican name. (*Pharmacographia.*) In the Indian vernaculars there is no special name for them, and they are not mentioned by any Sanskrit writers. Up to the present time the cultivation of the plant is carried on more extensively at Goa than at any other place in Western India, and capsicums are well known in Bombay as *Govai-mirchi*, "Goa pepper." The Arabs call the chillie Filfil-ahmar, "red pepper," in Persian it is Filfil-i-surkh, which has the same meaning. Besides the two species commonly cultivated, several varieties of *C. grossum* are met with in India as ornamental plants in gardens; they are mostly remarkable for the size of their fruit; which is almost or entirely devoid of pungency; one variety, which has been named *C. cerasiformis*, has globular fruit resembling a cherry. A yellow capsicum, having a peculiar flavour, has been introduced into India from Nipal, and from it is prepared a very highly esteemed Cayenne pepper. In India *C. minimum*, though common in many parts of the country as a weed of cultivation, is seldom used by the natives, who call it Gachh-mirch, "tree pepper," or Káfri-mirch, "negro's pepper." The Hindus and Indian Mahometans use capsicum very freely as a condiment, but the Arabs and Persians object to it. Medicinally the natives of India consider capsicum to be stomachic and stimulant, and

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a promoter of the regular action of the bowels: externally they use it as a rubefacient. The irritant properties are frequently taken advantage of to inflict torture upon prisoners and refractory children. In European medicine capsicum is used in the form of a plaster, or liniment, made with the ethereal tincture, in rheumatic and neuralgic affections; it produces warmth and redness of the part. Pads dipped in a strong infusion of the crushed pods may also be used; they should be covered with paraffin paper or oil silk, and may be kept on for several hours; as a gargle, or in the form of lozenges, it is used in tonsillitis, pharyngitis and relaxed sore-throat. In the West Indies it is used in infusion with cinnamon and sugar to relieve the sinking at the epigastrium felt by drunkards, and forms a most valuable diet drink for patient suffering from delirium tremens, as it satisfies the craving for stimulants. Large doses taken internally by persons who are not in the habit of using capsicum may produce gastroenteritis.

Description.—The berry is very variable in size and shape, and many-seeded. The fleshy pericarp is composed of two layers, an outer consisting of thick-walled cells, and an inner, which is a soft and spongy parenchyme traversed by fibro-vascular bundles. Most of the colouring matter is contained in the outer layer, which also contains some fatty oil. The seeds are discoid, smooth or sub-scabrous; the embryo peripheric.

Chemical composition.—Thresh (*Pharm. Jour.* (3) vii. 21, 259, 473,) succeeded in isolating a well-defined highly active principle, *Capsaicin* ($C^9H^{14}O^2$), from the extract, which he obtained by exhausting the fruit of *C. minimum* with petroleum ether. From the red liquor dilute caustic lye removed capsaicin, which is precipitated in minute crystals by passing carbonic acid through the alkaline solution, and which may be purified by recrystallizing them from either alcohol, ether, benzene, glacial acetic acid, or hot bisulphide of carbon; in petroleum ether capsaicin is but very sparingly soluble, yet

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dissolves abundantly on addition of fatty oil. The latter being present in the pericarp is the cause why capsaicin can be extracted by the above process.

Capsaicin forms colourless prismatic crystals insoluble in water; it begins to volatilise at 100° C. and is powerfully irritant. The pungent taste is removed by heating with potassium bichromate and dilute sulphuric acid. Ba Cl^2 and $CaCl^2$ in alcoholic solution give a precipitate soluble in ether; $AgNO^3$ gives a precipitate soluble in ammonia, and Fe^2Cl a red precipitate when warmed.

Capsicine, an alkaloid, has also been extracted by benzene from the fruit of *C. minimum*. The benzene is evaporated and the residue dissolved in ether, from which the alkaloid is obtained by shaking with dilute H^2SO^4 (*Thresh*, *Pharm. Journ.* [3] vi. 941). It forms needles insoluble in water and very soluble in alcohol and ether, which may be sublimed or volatilized with steam, and are free from pungency. The hydrochloride crystallises in cubes and tetrahedra, the sulphate in prisms. (*Watt's Dict. Chem.*, 2nd Ed. i., 678.) A. Meyer has discovered that capsaicin is not, as has been generally assumed, distributed throughout the entire fruit, but only occurs in the light yellowish-red placentæ and their attachments. These parts yield 0·9 per cent. of capsaicin. According to G. Laube and H. Aldendorff capsicums contain Water 12·68, Nitrogenous substances 4·31, Volatile oil 3·05, Fat 8·17, Sugar 2·54, Nitrogen-free extractive 43·38, Cellulose 22·50, Ash 2·87 per cent., and when dried yield 0·79 nitrogen and 12·85 per cent. of volatile oil and fat. According to Warnecke, the ash of capsicums amounts to 4·66 per cent.

The colouring matter of capsicum fruits is sparingly soluble in alcohol, but readily in chloroform. After evaporation an intensely red soft mass is obtained, which is not much altered by potash, it turns first blue, then black with concentrated sulphuric acid, like many other yellow-colouring substances. By alcohol chiefly *palmitic* acid is extracted from the fruit, as shown by Thresh in 1877.

Commerce.—Several varieties of *C. frutescens* are cultivated throughout the plains of India for local consumption which is very large, but of which statistics are not available. *C. minimum* is common as a weed of cultivation in most parts of India, but is little used by the natives. The average value of capsicums in the Bombay market is about Rs. 12 per cwt.

WITHANIA SOMNIFERA, *Dunal.*

Fig.—*Jacq. Ecl. tt.* 22,23; *Sibth. Fl. Græc.*, t. 233; *Wight I.*, *t.* 853; *Rheede, Hort. Mal. iv.*, *t.* 55. Moorenkappen (*Dutch*)

Hab.—Dry sub-tropical India, West Coast. Southern Europe. The root and leaves.

Vernacular.—Asgandh (*Hind.*, *Guz.*), Asvagandhá (*Beng.*), Asvagandhá, Tula, Dorgunj, Kanchuki (*Mar.*), Amkúláng-kálang (*Tam.*), Pénérrú-gadda (*Tel.*), Hirimaddina (*Can.*)

History, Uses, &c.—This plant bears the Sanskrit names of Asvagandha, Turagi or Turangi, and Turagi-gandha, "smelling like a horse or mare"; Varáha-karni, "boar-eared"; Vrisha, "amorous," &c. It is described in the Nighantas as tonic, alterative, pungent, astringent, hot and aphrodisiac, and is recommended in rheumatism, cough, dropsy, consumption and senile debility. Chakradatta recommends it in decoction with long pepper, butter and honey in consumption and scrofula. A *ghrita* or medicinal butter prepared by boiling together one part of the root with one part of clarified butter and ten of milk may be used in such cases. As an aphrodisiac and as a remedy for rheumatism the drug is usually combined with a number of aromatics, each dose contains about 30 grains of the root. It is also made into a paste with aromatics for local application in rheumatism. Indian Mahometan writers merely repeat what the Hindus say about this drug, and do not recognise in it the Kaknaj-el-manoum of the Arabs, which is supposed to represent the στρυχνος ὑπνατικος of the Greeks, the description of which by Theophrastus agrees

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tolerably well with *W. somnifera.* Rheede calls it Pevetti, and states that a vulnerary ointment is prepared from the leaves. Prosper Alpinus (i., cap. 33) describes and figures it under the name of *Solanum somniferum antiquorum.* Roxburgh states that the Telinga physicians reckon the roots alexipharmic. Ainslie (ii. 14) says:—"The root as found in the medicine bazars, is of a pale colour, and in external appearance not unlike our gentian; but it has little sensible taste or smell, though the Tamool Vytians suppose it to have deobstruent and diuretic qualities, given in decoction to the quantity of about half a teacupful twice daily; the leaves moistened with a little warm castor oil, are a useful external application in cases of carbuncle." The authors of the *Bombay Flora* say that the seeds are employed to coagulate milk like those of *W. coagulans.* We have tried the experiment and find them to have some coagulating power.

The plant is very common along the shores of the Mediterranean, where it has always been reputed to be hypnotic. The properties of *W. somnifera* have recently been investigated by Dr. Trebut with regard to its reputation for hypnotic properties; he states that he has obtained an alkaloid from it which has hypnotic action and does not produce mydriasis. P. L. Simmonds (*Amer. Journ. Pharm.*, Feb., 1891) states that the plant is employed at the Civil Hospital, Aiger, as a sedative and hypnotic.

Description.—The plant has a long tapering light brown root, which may attain the size of a carrot; it is surmounted by a knotty crown, from which spring several shrubby, flexuose round branches, 1 to 5 feet in length. The leaves are double, ovate, entire, 2 to 4 inches long; flowers axillary, subsessile, crowded at the ends of the branches; corolla campanulate, yellowish green, very small; berry red, smooth, size of a pea, covered by a membranaceous closely-fitting calyx, open at the apex; seeds numerous, yellowish white, reniform, laterally compressed, about $\frac{1}{16}$th of an inch long; testa honeycombed. The whole plant is covered with small branched and pointed

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white hairs, which give it a hoary appearance. The odour is pungent and disagreeable like horse's urine.

The dried root as it appears in commerce is of very uniform appearance, being from 4 to 8 inches long, and from ¼ to ½ an inch in diameter at the thickest portion a little below the crown; it is plump, smooth, tapering, and of a light yellowish brown colour externally, white internally, brittle; fracture short and starchy. The root is seldom branched. Attached to the crown are the remains of several slender stems. Microscopic examination shows the substance of the root to be principally composed of starch, enclosed in delicate oval cells; the cortical portion is about $\frac{1}{20}$ inch in thickness. The vascular system consists of a large central bundle of scalariform and dotted vessels; round this several smaller bundles and single vessels are arranged in a radiating manner. It has a mucilaginous and slightly bitter taste. In the "*Materia Medica of Western India*" an opinion is expressed that the commercial article cannot be the root of *W. somnifera*. This opinion was founded upon a comparison of the drug with the root of that plant as found in the salt marshes near Bombay, where it acquires a twisted, woody form, entirely different to the tapering, starchy root which it has when growing in sweet soil. Young roots obtained from Satara exactly corresponded with the drug of commerce. Another point of difference is the red colour of the inner bark in the Bombay roots, which was not observed in those from the Deccan. The foliage, flowers and fruit of both plants appear to be identical.

Chemical composition.—Dr. Trebut in 1886 separated an alkaloid from the Mediterranean plant, which forms a crystalline sulphate having hypnotic action, but not producing mydriasis. He provisionally named the alkaloid *Somniferine*. (*Lancet.*) The root bark of the Indian plant, reduced to fine powder and exhausted with alcohol, afforded a deep red-coloured tincture which left a brittle red extract when evaporated to dryness. The extract yielded to acidulated water an alkaloid giving precipitates with the ordinary reagents as well as the alkalies. The alkaloid

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was left as an amorphous substance from its solution in ether, but gave crystals when neutralized with sulphuric or hydrochloric acid. It had a bitter taste, was not coloured with nitric acid, but with sulphuric acid and alcohol it imparted a red colour similar to that produced by solanine. A solution of the neutral acetate of the alkaloid was found to have no action upon the eye. A fatty and colouring matter were also present in the root; the latter was resinoid, and the alkaloid was combined with an astringent acid. The leaves afforded 19·5 per cent. of ash, and a trace of alkaloid was detected in them.

Toxicology.—Dr. Burton Brown (*Punjab Poisons*) records a fatal case of poisoning by the seeds of this plant. The symptoms observed were vomiting, insensibility, convulsions; the patient became unconscious with dilated pupils insensible to light; there were continued tetanic spasms of the muscles of the face and extremities, tongue not bitten, no lockjaw, face and lips livid, veins distended.

WITHANIA COAGULANS, *Dunal.*

Fig.—*Wight Ic., t.* 1616; *Stocks in Hook. Ic., t.* 801.

Hab.—Punjab, Sind, Afghanistan. The fruit.

Vernacular.—Panirband, Panir-ja-fota (*Sind.*), Khamjaria (*Punjab*), Spin-bajja (*Afghan.*), Akri (*Hind.*), Kakanaj (*Bomb.*).

History, Uses, &c.—A small, rigid, grey undershrub, the fruit of which is commonly used in Sind, N.-W. India and Afghanistan to coagulate milk instead of rennet; the natives of those countries rub up a few of the fruits with a small quantity of milk and add this to the milk to be coagulated. This useful plant appears to have attracted little notice until 1849, when it was described by Dr. Stocks (*Journ. Bomb. Asiat. Soc.*, 1849, p. 55). The fruit is also used as an emetic, and smaller doses as a remedy for dyspepsia arising from chronic liver disease: it is alterative and diuretic. In Bombay it is usually confounded

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with the fruit of *Physalis Alkekengi*, Wild., imported from Persia, the Hab-el-káknaj or Káknaj of the Arabians, which is described by Ibn Sina as an alterative similar to Dulcamara, and especially useful in skin diseases. The berries of both plants have a reputation as blood purifiers. Recently, from experiments made by Sir J. D. Hooker at Kew, it has been ascertained that 1 oz. of the fruit of *Withania coagulans* and 1 quart of boiling water make a decoction, one tablespoonful of which will coagulate a gallon of warm milk in about half an hour. Experiments of a similar nature have been made on the Kilkerran Estate, the property of Sir James Fergusson, late Governor of Bombay, four ounces of the fruit were allowed to simmer for 12 hours in 1½ pint of water, and half the liquid was then added to 55 gallons of milk; the milk curdled in an hour and a half, affording a firm curd free from taste and smell; of this a cheese was made which proved to be excellent.

Description.—The entire fruit is about ⅜ of an inch in diameter, flattened at the base, and enclosed in a leathery close-fitting calyx, with a small 5-partite opening at the apex, through which a small portion of the fruit is visible; this is red when fresh, but yellowish and chaffy when dry; within is a mass of flattened reniform seeds nearly ⅛ of an inch in their longest diameter, and held together by a viscid brown pulp which has a nauseous fruity odour.

Chemical composition.—The following is Mr. Sheridan Lea's report upon the "rennet" ferment contained in the seeds:—

"Taking equal weights of the seeds, I extracted them for 24 hours with equal volumes of (1) water, (2) 5 per cent. sodic chloride, (3) 2 per cent. hydrochloric acid, (4) 3 per cent. sodic carbonate. Equal volumes of each of the above were added in an acid, alkaline, and neutral condition, to equal volumes of milk, and heated in a water-bath at 38° C. The milk was rapidly coagulated by the salt and sodic carbonate extracts, much less rapidly by the other two; of the four, the salt extract was far the most rapid in its action. All subsequent experiments have

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shown that a 5 per cent. solution of sodic chloride is the most efficient in the extraction of the active principle from the seeds.

There is no doubt that the substance which possesses the coagulating power is a ferment closely resembling animal rennet.

I.—A portion of the 5 per cent. sodic chloride extract loses its activity if boiled for a minute or two.

II.—The active principle is soluble in glycerine, and can be extracted from the seeds by this means; the extract possesses strong coagulating powers even in small amounts.

III.—Alcohol precipitates the ferment body from its solutions; and the precipitate, after washing with alcohol, may be dissolved again without having lost its coagulating powers.

IV.—The active principle of the seeds will cause the coagulation of milk when present in very small quantities, the addition of more of the ferment simply increasing the rapidity of the change.

V.—The coagulation is not due to the formation of acid by the ferment. If some of the active extract be made neutral or alkaline, and added to neutral milk, a normal clot is formed, and the reaction of the clot remains neutral or faintly alkaline.

VI.—The clot formed by the action of the ferment is a true clot, resembling in appearance and properties that formed by animal rennet, and it is not a mere precipitate.

The question of preparing an extract which should be capable of being kept for a considerable time is perhaps of importance. Ordinary commercial rennet usually contains a large amount of sodic chloride and some alcohol. One specimen I analysed contained 19 per cent. of common salt, and 4 per cent. of alcohol. I have, therefore, added to the 5 per cent. chloride extract mentioned above enough salt to raise the percentage of this to 15 per cent., and also alcohol up to 4 per cent. The activity of the extract is not appreciably altered by this, and

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such a preparation corresponds very closely in activity with a commercial solution of animal rennet with which I compared it. The possibility of making extracts which may be expected to keep, is thus indicated, but, of course, time alone will show whether the activity of the ferment is impaired to any important extent by such keeping.

I may add, in conclusion, that I have coagulated a considerable volume of milk with an extract such as I have described, and prepared a cheese from the curds. I have also given a portion of the extract to a professional cheese-maker, who has used it as a substitute for animal rennet in the preparation of a cheese. The product thus obtained, and the statements of the person who has made the experiment for me, lead me to suppose that extracts of the seeds of Withania can be used as an adequate and successful substitute for animal rennet." (*Pharm. Journ.* [3] xiv. 606.)

An attempt has been made by Mr. D. S. Kemp, of Bombay, to preserve the ferment by means of sugar, but with only partial success.

ATROPA BELLADONNA, *Linn.*

Fig.—*Eng. Bot. t.* 934; *Bentl. and Trim. t.* 193. Common Dwale, Deadly Nightshade (*Eng.*), Belladone, Morelle furieuse (*Fr.*).

Hab.—Western Himalaya, Persia, Europe. The root and herb.

Vernacular.—Suchi (*Hind.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit medical writers, and does not appear to have been ever used medicinally in India. It appears to correspond pretty well with the *στρύχνος μανικος* of the Greeks, though it cannot with certainty be identified. The Arabian writers simply copy from the Greeks their account of the different kinds of strychnos and describe them as varieties of Inab-eth-thálib, a

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general name in Arabic for the Nightshades. Háji Zein-el-Attar (A. D. 1368), speaking of Inab-eth-thálib, in Persian Rubah-turbak and Sag-angur, "foxes' or dogs' grapes," concludes by cautioning his readers against the use of a kind with black berries, which causes delirium and is highly poisonous. In cases of poisoning by the latter plant he directs emetics to be given, and milk or honey and water, with aniseed and bitter almonds, to be administered.

The use of Belladonna as a medicine is of quite recent date; it was only known to the ancients as a noxious herb. Its action upon the pupil of the eye appears to have been utilized in the 16th century by the Italian ladies, whence the name Herba Belladonna. (*Matth. Comment.* (1558) 533.)

Physiological action.—All animals are not equally affected by this poison. It has been observed that rabbits can feed upon the plant with impunity, and that the pupils of their eyes may be dilated by the application of their own urine. Birds eat the fruit, and, strange to say, the drug has no local action upon their eyes. Hecquet has observed the insusceptibility of marsupials to the poisonous action of belladonna, and snails and slugs feed upon its leaves with impunity. Atropine has no injurious effect when injected into the blood vessels of birds and herbiverous animals, it is therefore evident that their nervous system is not susceptible to its toxic action.

The carnivora, under the influence of the drug, exhibit along with dilated pupils, evidences of suffering, retching or vomiting, general muscular debility, dulness of the senses, and increased frequency and force of the heart's action, but no delirious excitement is observed. (*Acad. des Sciences, Séance du* 28 *Juin*, 1875.)

In man when poisonous doses of belladonna have been taken, a sense of tightness or pain is felt in the forehead and eyes, with giddiness, confusion of thought, and noises in the ears. The sight is confused, objects are hazy or their character is mistaken. Often they appear to be much smaller than natural. Spectral illusions, generally of a pleasing character, are frequent, such as jewels, flashes of coloured light, birds of brilliant plumage, and insects with enamelled wings. In other cases they have the hideous appearance of the phantasms of delirium tremens. Sometimes there is a total blindness of several days' duration, and even after all mental disorder has subsided. The mind is apt to be filled with extravagant ideas; there is often delirium, which is generally of a gay description, and which prevents sleep or disturbs it with fantastic dreams. Sometimes the patient is quite conscious of his illusion and delirium, but is without the power to control either of them. The latter may be characterized by the incessant repetition for hours of some habitual act or phrase; sometimes though rarely, it is violent, maniacal, and attended with injury to himself or the attendants; but, in general, poisonous doses of the drug give rise to active and, for the most part, joyous delirium. It is a powerful anæsthetic; in cases of poisoning by it ending in recovery there has been almost a total loss of sensibility of the skin, lasting for several days. It has no direct soporific operation. Belladonna in excessive dose renders the gait unsteady and staggering, producing numbness with trembling and jerking movements of the limbs; the patient unconsciously runs against objects in his way, or avoids encountering imaginary ones; he is unable to co-ordinate his movements or to pick up small objects. The pupil is dilated, the eyes bright, the voice husky, or deglutition, owing to dryness of the throat, is impossible; the bladder is paralyzed and the urine retained, or both this secretion and the fœces may be passed involuntarily. The upper eyelid is apt to be paralyzed, and may remain so for months. (*Stillé and Maisch.*)

Symptoms exactly similar to these have frequently been recorded in cases of datura-poisoning in India. The action of belladonna on the brain has been attributed to a deficiency of blood in that organ caused by stimulation of the vaso-motor nerves, but as ligature of the carotids is not followed by any of the peculiar symptoms produced by belladonna, this explanation does not appear to be reasonable. The drug appears to exert some special action on the brain which is not understood.

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The action of belladonna on the spinal cord also has not been satisfactorily explained. The spinal symptoms observed after poisonous doses, *viz*., suspension of mental control over movements and their co-ordination, seem to result from impaired sensibility and power of motion. Gubler, two hours after the subcutaneous injection of several milligrams of sulphate of atropine, observed symptoms of paralysis of both motor and sensory nerves, the patient being unable to button his clothes from want of power and feeling in the fingers. (*Gubler, Dict. Encyclop. des Sci. Med.* (1) *t.* vii. *et* ix.)

Like all other medicines which act directly through the nervous system, small and large doses of belladonna produce opposite effects, the former stimulating, the latter paralyzing it. The direct action of small doses upon the heart is to increase the vigour and the frequency of its contractions; but large doses render the pulse still more frequent, but more and more feeble and thready.

Under the action of full doses of belladonna the pulse is at first slower and fuller, contrary to what takes place in the lower animals after the subcutaneous injection of atropine, but afterward becomes more frequent, as well as more feeble, until in fatal cases it grows thready and intermittent. During the active period of the operation the whole capillary circulation would seem to be congested, for the external mucous membranes are dry, the face is red and turgid, there is a sense of fulness in the head, with throbbing of the arteries, as if the blood were prevented from returning to the heart by a ligature around the neck. But the intracranial pressure does not appear to be increased in a like proportion. (*Jacobi.*) The general dryness of the skin and throat and larynx contrasts with the greatly augmented secretion of the kidneys during the active stage of belladonna-poisoning. This diuresis has been attributed to the fact that the active principle of the drug is excreted with the urine, and almost exclusively in this manner. Irritation of the scrotum sometimes exists in a high degree. (*Stillé and Maisch.*)

Amongst the most remarkable and earliest indications of the action of belladonna is dilatation of the pupil, and loss of the power of accommodation, the degree and persistence of these symptoms being in proportion to the dose employed. The defects of vision produced by the drug are various, there may be want of defining power, diplopia, presbyopia, want of the power of accommodation or even amaurotic amblyopia. Some of these defects may even persist when the natural diameter of the pupil has been restored by eserine or has gradually recovered its normal condition, which indicates that the retina itself has lost some of its sensibility. The manner in which the drug acts upon the pupil has been much discussed by physiologists; Gubler, who has thoroughly investigated this question, admits that the various theories which have been suggested, *viz.*—paralysis of the iris, excitation of its radial fibres, paralysis of the ciliary nerves or their spinal centres, contraction of the blood vessels of the veins, torpidity of the ophthalmic branch of the trigeminal and of the retina—are individually insufficient to explain the physiological fact. He considers it to be of a complex nature, and that several of the causes above mentioned contribute to its production. The solution of the problem becomes more difficult when we consider the resistance of the iris of birds to the action of the drug. Rossbach and Frölich have observed that in rabbits and frogs the pupil contracts before dilating. (*Gubler*, *loc. cit.*)

Belladonna is antagonistic in certain respects to eserine, opium, ergotine and pilocarpine, *viz.*, with eserine and ergotine as regards its action on the pupil, with pilocarpine as regards its action on the secretions of the skin, and with opium as regards its action on the brain. Its antagonism to opium is of most importance, as numerous cases are on record in which atropism has been controlled by morphia; on the other hand, the narcotism of opium has equally been arrested by atropine.

The medicinal applications of the drug are numerous. As a sedative it is prescribed in neuralgia, colic, gastralgia, constipation, nocturnal incontinence, and photophobia. As an antispasmodic it is useful in tetanus, cramps, and painful contraction of the involuntary muscles; as a mydriatic in pupillary stenosis, cataract, iritis, posterior synechia, and during the operation for, and after treatment of cataract. In convulsive disorders it has been used with small success in epilepsy, chorea and eclampsia. To control secretions it is used in excessive perspiration, profuse salivation, copious catarrhal defluxions and to arrest the secretion of milk. As a preventive against scarlatina it is supposed by some to act by rendering the condition of the mucous membranes less favourable to the absorption of the poison.

As an antidote it is used in poisoning by opium, eserine and muscarine.

Description.—An herbaceous plant with thick, smooth stems, 4 to 5 feet in height; leaves 3 to 6 inches long, stalked, broadly ovate, acuminate, attenuated at the base, pubescent when young; flowers solitary, campanulate, pendulous, purplish-green; berries black, large and shining. The fresh plant has a fetid odour and a nauseous faintly bitter taste. The berries are sweet. The root is large, fleshy, tapering and branched, 1 to 2 inches thick, and a foot or more in length, it has a thick, light brown bark, and is internally of a dirty white colour. Odour not peculiar; taste acrid.

Chemical composition.—All parts of the plant contain *atropine* together with *hyoscyamine.* Atropine, $C^{17}H^{23}NO^{3}$, crystallizes in needles from dilute alcohol; it is slightly soluble in water, and very soluble in alcohol or chloroform, and the solutions are alkaline and taste bitter. Its salts enlarge the pupil of the eye. Atropine is decomposed by hot baryta water or cold concentrated HCl into tropic acid, $C^{9}H^{10}O^{3}$, and tropine, $C^{8}H^{15}NO$. Crystalline tropine tropate has no action on the eyes, but when treated with dehydrating agents, such as $Zn\ Cl^{2}$, or HCl, atropine is formed. Tropine, according to Ladenburg, is a substituted tetrahydropyridine containing the methyl (CH^{3}) and the oxethyl $(C^{2}H^{4}OH)$ groups in place of two H atoms, and tropic acid is a phenyloxypropionic acid. By combining with tropine other aromatic acids we obtain tropeïns, a class of compounds analogous in constitution to atropine. One of these a compound of tropine with one of two isomeric phenyl-glycollic acids has been named homatropine, and has proved physiologically important. Atropine is the same as daturine, the active principle of the Daturas; it occurs along with hyoscyamine in those plants and also in Duboisia and probably in other Solanaceous plants. *Belladonnine* is an alkaloid occurring in the mother-liquor from which sulphate of atropine has been crystallised; it is amorphous, very slightly soluble in water, very soluble in alcohol, ether and chloroform. It is but slightly attacked by boiling baryta water, but is split up by alkalies into tropic acid and oxy-tropine, $C^8H^{15}NO^2$. This would indicate that belladonnine is oxy-atropine, $C^{17}H^{23}NO^4$. According to Merling belladonnine is $C^{17}H^{21}NO^2$, and gives tropine, atropic acid, and iso-atropic acid when boiled with baryta-water. For further information on the chemistry of atropine and its decomposition products, the reader is referred to *Watt's Dict. of Chem., 2nd Ed.*; *Stillé and Maisch, National Dispensatory, 4th Ed.*; *Liebig's Annalen*; *Berichte der deutsch. Chem. Ges.* *Atropamine* is a new alkaloid found by Hesse in Belladonna root, where it is occasionally present in considerable quantity. It is amorphous, melts at 60° C., is easily soluble in alcohol, ether and chloroform, has the formula $C^{17}H^{21}NO^2$ (differing from atropine, that is, hyoscyamine and hyoscine, by containing one H^2O less; but identical with pure belladonnine). It differs from the other belladonna alkaloids by forming beautifully crystallized haloid salts; it is optically inactive; the hydrochlorate in 2 per cent. solution is not mydriatic. Atropamine is only decomposed by prolonged boiling with alcoholic baryta solution, yielding tropine and an unknown acid, which may under some conditions re-arrange its atoms to form cinnamic or isocinnamic acid. Mineral acids easily bring about the decomposition, but first convert the atropamine into belladonnine; this easy decomposition may explain why the alkaloid was not sooner discovered as it is easily isolated. It is precipitated from its salts by ammonia, potash and soda as oily drops. (*Pharm. Ztg.* 1890, 471; *Amer. Journ. Pharm.* Sept. 1890.)

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Mr. A. W. Gerrard has obtained the following amount of alkaloid from Belladonna roots and leaves from plants of different ages:—

Age.	Wild. Yield from root.	Yield from leaves.
2 years	·260	·431
3 "	·331	·407
4 "	·410	·510
	Cultivated.	
2 years	·207	·320
3 "	·370	·457
4 "	·313	·491

Prof. Schmidt. and Mr. Schütte (*Apoth. Ztg.* 1890, 511) have obtained the following alkaloidal results from Belladonna roots:—

Taken in	Old roots.	Young roots.
	Per cent.	Per cent.
Spring........................	0·174	0·127
Summer	0·358	0·452
Autumn	0·280	0·458

They found that the young roots contained only hyoscyamine, and the old roots much hyoscyamine and a little atropine; no difference was observed between roots collected in spring, summer or autumn.

Toxicology.—Cases of fatal poisoning by belladonna are few in number. A lad of sixteen died from a drachm of the extract, and a woman of sixty-six after swallowing "a teaspoonful of belladonna liniment." A woman, having taken ½ ounce each of Lin. belladonnæ and Lin. aconiti (*Br. Phar.*), died in spasms within half an hour. (*Edinb. Med. Jour.*, xxvii. 443.) A man having liquefied an ointment containing 2½ drachms (gm. 10) of extract of belladonna, injected it into his bowel. He voided a portion of it, but the remainder caused the most marked symptoms of belladonna-poisoning. Recovery ensued without special treatment. (*Bull. de therap.* ci. 239.) Children have a remarkable tolerance of belladonna. After death by belladonna or atropine the lungs and right side of the heart are engorged, the brain and meninges are congested, and the retina is hyperæmic, and a corresponding condition of the spinal cord has been observed. (*Stillé and Maisch.*)

No cases of criminal poisoning by Belladonna have been recorded in India, but poisoning by Datura is extremely frequent (see *Datura*). Dr. Warden (*Ind. Med. Gaz.* 1879,) records a non-fatal case of poisoning ensuing upon the hypodermic injection of 5 to 6 drops of Liq. Atrop. Sulph., B. P. Immediately after the injection the medical officer in charge of the case states that he scarified the part, and pressed out as much of the injected fluid as possible. Within five minutes after the injection, the patient complained of vertigo, was unable to sit in a chair, and had to be carried to a bed. Within an hour after the injection the patient was delirious, the symptoms appeared to occur in paroxysms. The pupils were much dilated. Three hours after the injection the patient was quieter, save for an attack of furious delirium. Micturition was increased; the pulse between 130—140 and rather weak. Six hours after the injection, the patient was picking up imaginary objects, tying up imaginary rupees in his clothes, spinning, and carrying his fingers along imaginary threads; at times he would dig at the ground with his fingers and look for his shoes, all the while talking incessantly. 10½ hours after the injection the symptoms had considerably abated, and during the night sleep was disturbed by wild dreams. On the following morning the patient stated that he had very little recollection of the events of the preceding day. Assuming 5 drops to have been injected, the amount would be equivalent to ·0418 of a grain of the sulphate.

Dr. E. Lawrie of Hyderabad, Deccan (*Medical Record*, 1890,) has recorded a case of accidental poisoning by atropine, in which 4 grains were taken in mistake for antipyrin, the patient soon became unconscious, and although the contents of the stomach had been removed, and all approved methods for restoration tried, his condition appeared hopeless, when Dr. Lawrie injected one grain of morphia subcutaneously, and maintained artificial respiration, a second grain of morphia was injected, and after 7 hours a third grain. One hour after the last injection the patient was restored to consciousness.

MANDRAGORA OFFICINARUM, *Linn.*

Fig.—*Bulliard Herb.*, *t.* 145. Mandrake (*Eng.*), Mandragore (*Fr.*).

Hab.—Levant. The root.

Vernacular.—Yebruj (*Ind. Bazars*), Lakshamana (*Hind.*), Kattai-jati (*Tam.*).

History, Uses, &c.—In the Nighantas the root of this plant bears the names of Lakshamana, "possessed of lucky signs or marks"; Putra-da, "child giver"; Rakta-vindu, "a drop of blood"; and Bhágini, "co-heiress." It is described as a promoter of conception, aphrodisiac, and a corrective of the condition known as *tri-dosha,* or a disorder of the three humors of the body: bile, blood and phlegm. The Hindus appear to have derived their knowledge of the drug from Western nations, or possibly from the Chinese, as the only Indian species of Mandragora, *M. caulescens,* Clarke, is not known to be used medicinally. From the time of Hippocrates to the first century of the Roman Empire, mandragora was used medicinally by the Greek physicians, sometimes as an anæsthetic before surgical operations, but more frequently as an application to painful tumours. The root bark was preferred as being the most active part, but the leaves were also used, more especially for local application. Internally the juice of the root was usually administered in wine or vinegar. The description of the action of mandragora juice given by Dioscorides and Pliny leave no doubt of its resemblance to that of belladonna. Theophrastus and Dioscorides mention that the plant was also used in love

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philtres, which appears to be explained by the sensual excitement and hallucinations that are observed in datura poisoning. Like many other medicinal plants Mandrake appears always to have been collected with certain superstitious ceremonies; it was supposed that it could only be drawn from the ground without danger to the collector by the assistance of a dog, who, after the earth round the root had been removed, was tied to it by the neck and beaten until his struggles effected its extraction, and not unfrequently the death of the animal. The ancients speak of two kinds of Mandragora, male and female, the former has been identified as *M. vernalis*, Berth.; it has larger leaves and fruit than *M. officinarum*. From the time of Theophrastus up to the fifth century of our era the superstitions which have surrounded the mandrake appear to have gradually multiplied: we then find it spoken of as *anthropomorphon* and *semi-homo*, and described as having a human form and wonderful fertilizing powers. In the Middle Ages it became a mystical magic root, which existed only in fancy, and was represented by a fictitious image in the form of a man or woman manufactured from some other root, and used by priests and charlatans as a charm. It is the *Alrúna* of German mythology, which was believed to be a gallow's mannikin sprung from the seed of men who were hanged; that when pulled out of the earth by a black dog it shrieked like a child.* It came to be regarded as a kind of talisman or fetish which could bring good fortune to its possessor. In France it was known as Mandagloire or Maglore (main de gloire), and was regarded as a kind of fairy which if well treated would bring good luck to its owner.

Chéruel (*Dict. Hist. des mœurs et coutumes de la France*) gives the following extract from an anonymous diary of the 15th century:—"En ce temps, frère Richard, cordelier, fit ardre plusieurs *madagfoires* (mandragores) que maintes sottes gens gardoient et avoient si grant foi en cette ordure, que pour vrai ils croyoient fermement que, tant comme ils l'avoient, pourvu qu'il fut en beaux drapeaux de soie ou de lin enveloppé, jamais ils ne seroient

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* De Gubernatis states that near Chieti, in the Abruzzes, it is still extracted from the ground in this manner.

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pauvres." This superstition, says Chéruel, was still current in the 18th century among the peasantry of France. Dr. Pereira mentions his having seen a rude representation of a human figure fashioned out of the root of *Bryonia dioica*, exhibited at an herb-shop in England as a Mandrake. The Arabs call the mandrake *Luffah*, a name which they also apply to a kind of melon known in Syria as Shammám and in Persia as Dastambuyeh, "perfuming the hands," the *Eucumis Dudaim* of Linnæus, and supposed to be the Dudaim or "love apple" of Gen. xxx. 14. In Persia the mandrake is known as Mardumgyah and Sagshikan. Mahometan medical writers, under the name of Yebruj, Yebruh or Yebruj-el-sanam, reproduce with slight modifications the European myths concerning the plant. Haji Zein-el-Attar states that on the borders of the Garmasir of Shiraz, near the fort of Shahryari, mandrake root was in his time (A. D. 1368) collected with the assistance of dogs, and was known as Sagkand (*Sag*, "a dog," and *kandan*, "to dig"). In cases of poisoning by it he recommends emetics and the administration of aromatics in milk, and concludes by saying that it is beyond the province of medicine to discuss its use as a love-philtre. Mandrake roots, though not well-known in India, are occasionally offered for sale as a charm; the narcotic properties of the plant do not appear to be known to the natives. In China the plant is said to be much used as an anæsthetic, and in Europe the leaves are still sometimes used as as a local application to tumours. Guibourt says:—"Les feuilles font partie du baume tranquille (Élæolé de solanées composé).

Description.—Mandragora is a perennial plant, with a long, thick, fusiform, light brown root, which often bifurcates; the leaves are all radical, petioled and humifuse, broad, acute, with undulating edges; flowers numerous, on peduncles shorter than the leaves; fruit a yellow berry, which in *M. vernalis* (male mandrake) is round and the size of a crab-apple, whilst in *M. officinarum* (female mandrake) it is ovoid and rather smaller. The leaves of the latter plant are also narrower and smaller than those of the so-called male mandrake. The plants when fresh have a nauseous acrid odour.

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Chemical composition.—Herr Ahrens reports that he has separated two basic substances that are probably isomers of hyoscyamine (*Annalen*, .ccli., 312.) The residue from the evaporation of an alcoholic extract of the roots was treated with acidulated water, the solution treated with potassium carbonate in excess and then shaken with ether and the ether evaporated, when a deliquescent alkaloidal substance was left, which when dried over sulphuric acid resembled a brittle resin. When neutralized with sulphuric acid it formed a sulphate crystallizing in white scales, a solution of which dropped into the eye dilated the pupil. Analysis of the gold salt gave results pointing to the formula $C^{17}H^{23}NO^3$,HCl, AuCl, or the same as that of hyoscyamine, atropine and hyoscine. But although the gold salt had much of the external appearance of hyoscyamine gold salt, and a melting point only six or eight degrees lower, the properties of the other salts studied differed widely from the corresponding salts of hyoscyamine, and moreover the new substance was not converted into atropine by prolonged contact with alkaline liquor. Herr Ahrens is therefore convinced that the substance is a new isomer of the belladonna alkaloids and has named it "*mandragorine*." The press residue left after the extraction with alcohol was then treated with acidulated water and the aqueous solution supersaturated with potassium carbonate was shaken with ether, which left on evaporation an oily base that did not crystallize over sulphuric acid. A solution of the sulphate of this substance, which could not be obtained crystalline, when applied to the eye also dilated the pupil. The mercuric chloride, platinochloride and gold double salts were obtained crystalline; but the quantity available was too small to allow of the determination of its composition, although Herr Ahrens thinks it is probably another isomer of the belladonna alkaloid. (*Pharm. Jour. June 8th*, 1889.)

DATURA STRAMONIUM, *Linn*

Fig.—*Eng. Bot.*, *t.* 935; *Bentl. and Trim.*, *t.* 192. Thorn apple (*Eng.*), Pomme épineuse, Herbe aux sorciers (*Fr.*).

Hab.—Temperate Himalaya, Afghanistan, Persia.

DATURA FASTUOSA, *Linn.*

Fig.—*Wight Ic., t.* 1396; *Rheede Hort. Mal. ii., t.* 28.

Hab.—Throughout India.

DATURA METEL, *Linn.*

Fig.—*Bot. Mag., t.* 1440; *Rumph. Herb. Amb. v., t.* 243.

Hab.—W. Himalaya, W. Deccan Peninsula. The roots, leaves and seeds.

Vernacular.—Dhatúra (*Hind.*), Dhútúra (*Beng.*), Dhatúro (*Guz.*), Umattai (*Tam*), Ummetta (*Tel.*), Ummatta (*Mal.*), Ummatté (*Can.*), Dhotara, Kánte-dhotara, Pisola (*Mar.*).

History, Uses, &c.—The Sanskrit names Dhustura or Dhattura, and Unmatta, "insane," include all the species and varieties of the plant, and are the source from which the vernacular names are derived. We know of no aboriginal name for the plant, and consequently infer that it was introduced into India at the time of the Arian invasion. The Marathi name Pisola appears to be derived from the Sanskrit पिस, to hurt or injure. Sanskrit writers sometimes specify whether black or white Dhustura is to be used, but do not draw any distinction between the properties of the different plants. In modern native practise the black or purple-flowered variety of *D. fastuosa* is preferred. In the Nighantas Dhustura bears numerous synonyms, such as Dhúrta, "rogue"; Kitava, "crazy"; Mátula, "maternal uncle"; Tarala, "libidinous," &c. It is described as intoxicating, digestive, emetic and heating; useful in fever, skin diseases, boils, itch, worms, insanity, &c. Hindu physicians frequently prescribe the drug in fever attended with catarrhal symptoms, but combine it with so many other remedies that it is difficult to judge how much of the effect produced is due to the Datura. The *Svalpajvaránkusa* may be taken as a specimen of this kind of prescription; it contains mercury, sulphur, aconite, ginger and long and black peppers, of each one part, to two parts of Datura seeds. The dose is 4 grains

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of the mass, which is directed to be made with the assistance of lemon juice.

As a local application to inflamed and painful parts, the pounded leaves mixed with turmeric in the form of a paste are much used as a domestic remedy. Similar pastes are made with the fruit and juice, with or without opium, and mixed with oil; they are used to destroy lice and in parasitic skin diseases.

A pill made of the pounded seeds is placed in decayed teeth to relieve toothache, and the leaves are smoked along with tobacco in asthma. According to Dutt, no mention of the latter use of the plant is to be found in old Hindu books. Mahometan writers also are silent upon this point. Ainslie found upon enquiry that the physicians of Southern India were unacquainted with the value of Datura in spasmodic asthma, but he tells us that his friend, Dr. Sherwood of Chittore, noticed the smoking of *D. fastuosa* as a remedy in that disease. In the Concan the juice of the same plant is given with fresh curds in intermittent fever to the extent of one tolá during the intermission, and at least two hours before the fever is expected. The seeds also often enter into the composition of the *bakha*, used in the fermentation of country spirits, and Norman Chevers states that *bakha* is also frequently added to Kaita (कैत), an intoxicating drink prepared from the fruit of *Feronia elephantum*, and indulged in by the lower classes during the Holi festival. The several species of Datura are described by Mahometan writers under the Arabic name of Jouz-el-mathil. The Persian name is Tátulah.* The author of the *Makhzan* recommends preference to be given to the purple kind; he says that all parts of the plant are powerfully intoxicating and narcotic; as a local application they relieve the pain of tumours, piles, &c. The roasted leaves applied to the eyes give relief in

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* *Datura Stramonium* is called τάτουλα in modern Greek, a name doubtless of Persian origin. This plant is a native of Northern Persia and Afghanistan, whence it appears to have been introduced into Europe some time before the discovery of America.

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ophthalmia, similarly they are useful in headache, enlarged testicles, boils, &c. The following description of Datura intoxication is by the same author:—"Every thing he (the patient) looks at appears dark; he fancies that he really sees all the absurd impressions of his brain, his senses are deranged, he talks in a wild, disconnected manner, tries to walk but is unable, cannot sit straight, insects and reptiles float before his eyes, he tries to seize them, and laughs inordinately at his failure. His eyes are bloodshot, he sees with difficulty, and catches at his clothes and the furniture and walls of the room. In short, he has the appearance of a mad man." (*Makhzan*, article "*Jouz-el-mathil.*")

The leaves and seeds of *D. fastuosa* have been made official in the *Pharmacopœia of India*, and of these a tincture, extract, plaster and poultice are directed to be made. The extract has been used successfully at the General Hospital, Madras, as a substitute for extract of belladonna. The value of the plant as a remedy for painful syphilitic nodes, tumours, &c., is well known to many European physicians in India.

For a description of the physiological effects of Datura, the reader is referred to the article upon Belladonna.

Description.—The leaves of *D. Stramonium*, *D. fastuosa*, and *D. Metel* are very similar; they have long petioles, are unequal at the base, ovate, acuminate, sinuate-dentate, with large irregular pointed lobes; when fresh they are firm and juicy, and have a disagreeable fetid odour, which they lose when dry. In *D. Stramonium* and *D. Metel* the young leaves are generally pubescent, in *D. fastuosa* they are glabrous. In size the leaves vary greatly, in vigorous plants the largest are 7 to 8 inches long and 4 to 5 in breadth. All the species have large trumpet-shaped, night-scented flowers, which in *D. fastuosa* vary much in colour and are often double. In *D. Stramonium* they are white, and in *D. Metel* purplish-white.

The fruit is an ovoid capsule about the size of a walnut, thickly studded with blunt spines; it is bilocular, with each cell

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incompletely divided into two, and in *D. Stramonium* opens at the summit, when ripe, in four regular valves, disclosing a large number of flattened, kidney-shaped black or dark brown seeds, about 2 lines long and ½ a line thick. The surface of the seeds is finely pitted, and also marked with a much coarser series of shallow reticulations. The embryo follows the outline of the seed, and has the tip of the radicle everted. The fruit of *D. fastuosa* dehisces irregularly when ripe, and the seeds are ear-shaped and of a light yellowish-brown colour. The testa is much thicker than in the seeds of *D. Stramonium*, but like them is reticulated and finely pitted. The seeds of both plants have a bitterish taste and disagreeable odour when bruised. The fruit and seeds of *D. Metel* agree nearly with those of *D. fastuosa*.

Microscopic structure.—The outer envelope of the seed is formed of a layer of thick-walled, sinuous cells, which in *D. fastuosa* and *D. Metel* are much more developed than in *D. Stramonium*, and contain secondary deposits; the inner is formed of tangentially extended cells. The albumen consists of polyhedral cells, containing granular matter and fatty oil. The structure of the embryo is similar, but the cells are much smaller.

Chemical composition.—Prof. E. Schmidt and Mr. Schütte (*Apoth. Ztg.* 1890, 511) found the seeds of *D. Stramonium* to contain much hyoscyamine with small quantities of atropine and hyoscine. M. Gérard (*Comptes rendus, Acad. des Sci.*, Aug. 11, 1890) has prepared a new fat acid, *Daturic acid*, from the seeds, which yield 25 per cent. of oil when extracted by ether. Purified with petroleum, this oil was of a greenish yellow colour. It was saponified with litharge; then the lead oleates were removed by ether, leaving a soap, from which the author isolated an acid fusing at 55° C. M. Gérard places daturic acid between palmitic and stearic acids, and it presents analogous properties to these. It crystallizes by cold from 85 per cent. alcohol giving groups of fine needles. It is fairly soluble in cold alcohol, and very soluble in ether and benzene.

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Formula $C^{34}H^{34}O^{4}$ (old notation). From *Répert. de Pharm.*, Sept. 10, 1890, in *Amer. Journ. Pharm.*, Oct. 1890. The air-dried seeds of *D. fastuosa* (purple var.) reduced to powder lost 7·828 per cent. of moisture when heated to 100° C. The ash calculated on the air-dried seeds amounted to 4·830 per cent., and was of a brick-red colour.

On proximate analysis the following results were obtained, calculated on the seeds containing 7·828 per cent. of moisture:—

Petroleum ether extract........................	11·654 per cent.
Ether extract, containing ·296 per cent. of oil soluble in petroleum ether	0·340 „ „
Absolute alcohol extract	1·382 „ „

The oil extracted by petroleum ether was of a pale straw colour, and had a slight odour of valeric acid. Exposed to a temperature of about 90—95° C. for several days, it slowly thickened. The oil extracted by ether was of a darker colour, and had a distinct fluorescence. After agitation with dilute sulphuric acid to dissolve any trace of alkaloid, and filtration through paper, it had a specific gravity at 15·5 C. of 9167. It thickened below 10° C. The ether extract contained oily matter soluble in petroleum ether, the insoluble residue was only partly soluble in dilute sulphuric acid, and the acid solution afforded marked evidence of the presence of an alkaloidal principle, which caused marked dilatation of the pupil when introduced into the eye. The alcoholic extractive contained a substance exhibiting a marked greenish fluorescence, a dark resin and an alkaloidal body. The gold salt of this alkaloid examined microscopically closely resembled the aurochloride of atropine. The total alkaloid extracted from the seeds amounted to ·088 per cent. Dragendorff states that the aurochloride of atropine dried at 100° C. contains 31·37 per cent. of gold; a salt having the formula $C^{17}H^{23}NO^{3}HAuCl^{4}$ would contain 31·31 per cent. of gold. We made two determinations of gold in the gold salt, prepared with alkaloid, after repeated purification; after drying first over sulphuric acid and then at 100° C., we found the gold content to be 30·513 per cent. The melting point of our gold salt was above 170° C. when heated in the dry state. The amount of alkaloid at our disposal was too small to admit of any attempt at fractionation.

Toxicology.—Datura poisoning is common in India, the seeds being usually employed; a few cases of poisoning by the leaves and root have, however, been reported. In the great majority of cases the motive for its administration is facilitation of theft, and when in India an individual has been first drugged and then robbed, it will usually be found that datura has been employed. A common form of theft by aid of this poison is road robbery, and Dr. W. Center mentions the use in such cases of a hollow pestle, the cavity containing the seeds. Inversion of this while pounding the *masaleh* or spices always used in Indian cookery, introduces the poison into the food without exciting suspicion. It rarely happens that there is any ground for suspecting homicidal intent in cases of datura poisoning; in fact, there seems to be a popular belief in this country that the drug is simply an intoxicant. As Harvey remarks, road poisoners sometimes partake with their victims of the drugged food, which they would hardly do if aware of the danger. Commonly, when datura is used for criminal purposes in India, the poison is mixed with sweetmeats or food, but in exceptional cases it has been mixed with tobacco given to the victim to smoke. Datura is said to be used by vendors of native liquor, for the purpose of increasing its intoxicating power, the liquor being poured into a vessel which has been first filled with the smoke of the burning seeds. Suicidal poisoning by datura, if it occurs at all, is extremely rare. Accidental poisoning among children is occasionally met with. (*Lyon, Med. Juris. for India.*)

For the symptoms of poisoning by this plant the reader is referred to the article upon Belladonna.

In a country where the habitual use of opium is so common it is difficult to say what may be a fatal dose of datura. Dr.

Giraud in 1843 met with only one death in fifty-one cases admitted into the Jamsetjee Jeejeebhoy Hospital, Bombay; and in the ten years ending 1885, of fifty-nine cases admitted into the same hospital, only two died. This, however, is an exceptionally low death-rate. Dr. Burton Brown, of Lahore, records twenty-one deaths in ninety-two cases. In Harvey's one hundred and twenty-three Bengal cases, twenty deaths were reported; and of the Bombay Analyser's one hundred and thirty-eight cases, twenty-four died. Here there is a marked difference in the fatality among cases treated in hospital and the last three sets of figures which represent cases referred to the Chemical Analysers from different part of the country, many of which would probably have recovered under medical treatment.

From the Reports of the Chemical Examiner, N.-W. Provinces and Oude, for the years 1879 to 1887, it appears that out of 110 cases referred to him, 9 were fatal. His report also shows a remarkable decrease in the number of cases in which Datura was detected in the various substances sent to him for examination. In 1879 and 1880, 20 and 25 per cent. of them contained this poison, in 1881 the percentage fell to 9 and remained at about that figure during the remaining 6 years.

In Bengal fatal cases of datura-poisoning are now very rare, as will be seen from the following table :—

Year.	Number of viscera examined.	Percentage of Datura detections.
1880-81	270	0·7
1881-82	210	0·4
1882-83	210	None.
Nine months of 1883	126	,,
1884	217	,,
1885	234	,,
1886	266	0·4
1887	233	None.

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In the Punjab fatal cases are more frequent, but their number appears to be declining, as will be seen from the following figures:—

Year.	Number of viscera examined.	Percentage of Datura detections.
1879	162	1·8
1880	194	2·0
1881	186	6·3
1882	201	0·9
1883	194	1·5
1884	200	0·5
1885	234	0·8
1886	272	0·7
1887	228	0·8
Madras—		
1882	152	·6
1883	123	1·6
1884	85	8·2
1885	81	4·9
1886	84	2·3
1887	76	None.
1888	91	1·1
1889	101	1·9

A case is reported by Taylor (*Poisons*, p. 774) in which a decoction of 125 seeds of *D. Stramonium* caused the death of an adult in seven hours: on the other hand, in Dr. E. Lawrie's case (see Belladonna), the patient, an adult, recovered under suitable treatment, after taking four grains of Atropine.

The following table, compiled by Assistant-Surgeon C. L. Bose, Assistant Chemical Examiner to the Government of Bengal, shows the particulars of poisoning by Datura in India:—

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle poisoning cases.	REMARKS.
Bengal	1873	......	6	......	
Do.	1874	1	15	......	
Do.	1876	1	......	......	
Do.	1877	3	......	......	
Do.	1878	......	29	......	
Do.	1879	1	......	......	
Do.	1880	2	16 (Seeds) 1 (Root).	......	
Do.	1881	1	2 (Fruit) 14 (Daturine and Datura.)	......	
Do.	1882	1	17 (Datura seeds and Daturine.)	......	
Do.	1883	......	7 (Datura seeds and Daturine.) 1 (Datura root).	......	

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
Bengal—(*contd.*)	1884	.....	7 (Datura) 1 (Datura and Asafœtida).	......	"Datura was not detected in any of the viscera examined during 1884. In the years commencing 1876-77 and ending 1882-83, datura was detected in one, three, none, one, two, one and one cases, respectively. Although not found in the viscera examined, datura was found in seven of the suspected substances and in three (?) other cases mixed with other poisons. From Satkhira, a female was reported to have been severely burnt and afterwards robbed by two persons who had been her guests for the night. It was suspected that these individuals poisoned the food of which she had eaten. Part of the remaining rice and meat were forwarded for chemical examination, and datura was detected in the meat." "Another of the cases was reported from Howrah. This case also was an attempt to drug a woman. One Ramnath Sircar and another person, name not yet known, poured a quantity of liquor from a bottle into a wineglass and offered it to the woman, who had no sooner taken the drink than she complained of a burning sensation in her throat, gullet and stomach, and immediately commenced to vomit. No poison was detected in the liquor or vomit, but datura was detected in the powder which was adhering to the interior of the wineglass."

Do.	1885	......	1	......
Do.	1886	1	6	......
Do.	1887	......	8	1
Do.	1888	......	13	......
Do.	1889	1	25	......

In a paper contributed by me to the *Indian Medical Gazette* for October, 1890, recording medico-legal work in the Chemical Examiner's Department, Calcutta, during 6 months in 1889, the following cases were cited as cases of Datura poisoning that came under observation during the period.

"In the case of an up-country boy reported from Hoogly, the following history was forwarded:—

"The nephew states that he and his uncle and his uncle's son were travelling together; they met two men who gave them a mid-day meal and soon after left them. Some hours afterwards the son went to sleep and died in his sleep. The nephew was sick and drowsy. The father states that he was robbed by the men.

"On examining the viscera, the active principle of datura was detected."

"Of the cases of drugging by datura, the most important one occurred in Calcutta, in which one man in the course of a fortnight succeeded in non-fatally poisoning and robbing three persons. The victims were lying insensible on the roadside and were taken to the Campbell Hospital, their stomachs washed out, and the washings sent to the Chemical Examiner's Department for analysis. In one of these cases 46, in another 8, and in the third 11 entire and some broken fragments of seeds of datura possessing the physiological action of the active principle of the drug were detected in the washings of the stomach. In connection with this case, two packets of powder, found with the accused, were also sent for examination, and the active principle of datura was detected in them. The man feigned insanity at his trial in the Sessions Court, but he was sen-

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					tenced to 7 years' imprisonment with hard labour. The man turned out to be a professional poisoner, and had been convicted of a similar offence in 1882 and sentenced to 5 years' imprisonment." "In three other cases of datura poisoning, no history was given, but in the rest the usual history of strangers taken into confidence, poisoning of the food and robbing of the victims was recorded."
Bengal—*(contd.)*......	1890	1	8	......	....
N.-W. P. and Oudh.	1865	......	1	......	"By the assistance of Major Manning, I have received from a professional poisoner retained at Benares under sentence of transportation as an approver, several specimens of datura in the proportions and in the forms usually administered. None of the doses of the powdered seed sent me exceeded in weight 25 grains, and this was asserted to be the amount usually given to produce insensibility in a full-grown man, mixed with one quarter of a seer of *suttoo* (grain parched or ground), the usual vehicle, the seed (reduced to the finest powder) is quite unrecognisable, by taste or by the microscope; the proportion in fact being 25 grains to 3,500."
Do.	1866	1	3	......	"Five cases of poisoning by datura were referred. In 4 of these I was able to detect the poison. The cases were briefly :—

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"No 135. A case of domestic poisoning, in which a woman administered datura to a man and a boy in some *chapatees* (cakes); both individuals recovered, having been taken early to hospital. The poison was detected in the *chapatees* of which they had partaken. The case occurred at Lucknow."

"No 183. Is curious in the apparent absence of all object for the crime. A man, his wife and his daughter attended a *mela* (fair) in the Allahabad District. They accepted from a stranger about half a seer of *atta* (flour) in exchange for some tobacco. Three days after, on their return home, the *atta* was cooked and partaken of by the mother and daughter. Both became insensible and the daughter died. I detected datura in the *chapatees* made from the *atta*, as also in the contents of the girl's stomach."

"No 193. This case and the one following were the only two cases of gang or road poisoning referred during the year. The victim in this case was a *sowar* (trooper), by name Ghupli, who was returning from Saugor to his home at Lallutpur with a well-filled purse containing Rupees 310; falling in with a party of 5 men, they journeyed together until his companions found an opportunity of giving him datura mixed in sugar, to eat with his *suttoo*. He became insensible and lay thus for eight hours. When he came to himself, his purse and companions were gone; but he had sufficient strength to drag himself to the nearest police post and give information. The poisoners were pursued and apprehended, and luckily for justice, the sowar had retained, tied up in a piece of cloth, a small quantity of the sugar which had been given him. This contained datura in a state of fine division."

"No 194. This case occurred in the Futtehpore District. Six men belonging to a marriage party returning from Lallutpore were drugged by a professional poisoner in an encampment on the Grand Trunk Road. The drug was given in 'sherbet.' Two of the men died. I failed to

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					detect datura by analysis, but the poisoner confessed that he had given that poison mixed in the sherbet." "No 223. Was a domestic case which occurred at Fyzabad. Three persons were affected, but recovered, having been taken early to hospital. Datura was found in the *chapatees* of which they had partaken."
N. W. P. and Oudh—(*contd.*)	1867	......	......	......	Datura was detected in 5 cases, but whether in human viscera or among suspected articles, is not mentioned in the report.
Do.	1868	......	......	......	"Datura was detected as having been used for a criminal purpose in 12 cases. "Datura seems to be used in two classes of cases,—by the regular gang poisoners, and by men to produce a temporary insensibility in women with a criminal purpose in view. In the former class the poison is so carefully triturated by the practised hands who administer it, and the dose is so nearly proportioned to the effects intended to be produced, that rarely any evidence of the presence of the poison is obtained. In the 2nd class, the carelessness and ignorance of the operator generally leave satisfactory evidence of the instrument used to effect his ends."
Do.	1869	22	......	......	"In 22 cases of poisoning, datura was found to be the cause of death. Two of the datura cases were perfect examples of the cold-blooded and heartless system pursued by the regular professional poisoner." 1. "Three men and a boy were travelling last May, from Bombay towards the N.-W. Provinces. They were joined

					at Hurdah by a man, who ingratiated himself by pleasant companionship, and every day, as they travelled, evinced his good fellowship by making sherbet for the whole party during their midday rest. At length, at a solitary spot on the banks of a stream near Bansa, in the Damoh District, they drank his sherbet for the last time; the three men were found dead and the boy roaming about close to their bodies in the restless delirium caused by datura. A man said to have been the poisoner was apprehended soon after in the Hosungabad District, and with him was found a carefully made powder of datura seeds, mixed with a little flour and sugar. I detected datura in the stomachs of all three victims of his heartless treachery. "In the other case, six men were seen to encamp near a village in the Moozuffernuggur District. After a time three of the men were found lying dead on the spot where they had encamped, their companions having disappeared. I found datura to have been the cause of death in all the three victims."
Do.	1870	......	......	......	Datura was detected in 20 instances, but whether in human viscera or among suspected articles, is not mentioned.
Do.	1871	......	......	......	Do. in 9 instances do.
Do.	1872	......	4	......	"The detection of datura is far from being on a satisfactory basis. In 3 out of the 4 cases in which it was detected the seeds or parts thereof were appreciable to the eye or to the microscope, but in the 4th case (No. 149) I discovered the datura by its physiological test, dilatation of the pupil. It was a case which had come from Sultanpore in Oudh, and the substance to be examined was a *chapatee*, and it was from an extract of it that I obtained the test in a very characteristic way. I have not yet succeeded in getting this test from the extract of a stomach or its contents, although it has been tried in almost every case of Datura poisoning which has been reported to me."

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
N. W. P. and Oudh—(*contd.*)	1873	......	......	......	Datura was detected in 26 instances; "in all these 26 instances in which it was found, it was in the contents of the stomach, in vomited matter, or in food."
Do.	1874	......	......	......	Datura was detected in 27 instances, but no mention is made whether the poison was detected in human viscera or among suspected articles.
Do.	1875	......	......	......	Do. in 23 instances do.
Do.	1876	......	......	......	Do. in 23 instances do.
Do.	1877	......	......	......	Do. in 28 instances do.
Do.	1878	......	......	......	Do. in 18 instances do.
Do.	1879	......	......	......	Do. in 20 instances do.
Do.	1880	......	......	......	Do. in 25 instances do.
Do.	1881	......	......	......	Do. in 9 instances do. In connection with one of these cases, "the Sessions Judge of Saharanpore sent a small parcel containing 150 datura seeds. I was asked first, if I could tell if these had been in a human stomach, and if so, how long; and, secondly, if instead of having been rejected by vomiting, they had been retained in the stomach of a woman, would they have caused death. To the first question, I could only answer that I did not know. To the second, I ventured to state that as the seeds were whole and also dry and hard, they would most probably not bring about a fatal issue, even if they had been retained in the woman's stomach."

N.-W. P. and Oudh—(*contd.*)	1882	......	......	......	Datura was detected in 11 instances, but no mention is made as to whether the poison was detected in human viscera or among suspected articles.
Do.	1885	......	......	......	Do. in 16 instances do.
Do.	1886	......	......	......	Do. in 21 instances do. Case "No 160 referred from **Muttra**. The substance examined was 5 sweetmeat balls, and they were suspected to contain datura. I found datura seeds, but that they were very small unripe seeds, and were so distorted in shape that their identity could only be made certain by preparing an extract from them and dropping it into the eye of a kid. The extract produced in a few minutes full dilatation of the pupil."
Do.	1887	......	......	......	Datura was detected in 14 instances, but no mention is made as to whether the poison was detected in human viscera or among suspected articles.
Bombay	1871	1	6	......	"The seven cases of poisoning in which portions of the datura plant, or of its alkaloid, were detected, include two deaths. In one of the fatal cases over 70 datura seeds were picked out of a piece of jowari cake, the remainder of which had been given to a man by his wife. In the other fatal case (circumstances not stated) the alkaloid was detected in the food given, in the matter vomited, and in the contents of the stomach. In two out of the five non-fatal cases, several persons were affected with symptoms of poisoning; in one of these cases the number of persons affected was stated to be 4, in the other the number is not given. Only one of the 18 cases of datura poisoning admitted into the Jamsetjee Jejeebhoy Hospital during the year under report is included in the 7 cases above mentioned."
Do.	1872	......	5	......	"Of the 5 cases in which datura was detected, in two the poison was contained in native bread, in two others the datura was detected in powders sent for examination, and in one case, the only fatal one of the five, the poison was found in the vomited matter of a patient in the Jamsetjee Jejeebhoy Hospital, who was admitted with marked

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					symptoms of datura poisoning, recovered and was discharged from hospital, but died 2 or 3 days afterwards. Cases of datura poisoning occurring in Bombay so rarely prove fatal that special interest attaches to this case, the symptoms, etc., of which are remarkable enough to be worth recording. While under treatment in hospital, the patient, an old woman, suffered from great tympanitic distension of the abdomen; this however was completely relieved before her discharge from hospital. She was dismissed from hospital seven days after admission, apparently quite well. Three days afterwards, or ten days after the administration of the poison, her death was reported. A *post-mortem* examination of the body was made, and from the notes of Dr. Anderson, House Surgeon, Jamsetjee Jejeebhoy Hospital, I gather that the following remarkable condition of parts was observed:—The abdomen was very greatly distended; on opening it the distension was found to be due to an enormously large stomach filled with fluid. No less than 4 gallons of fluid were contained in the viscus. At the lower part of the intestines three intussusceptions were found, but from the absence of any sign of inflammation in their neighbourhood, it was doubtful whether they were *ante-mortem* or *post-mortem* intussusceptions. As the intestines between the stomach and the seat of the intussusceptions were completely empty, it is very doubtful whether the dis-

					tension of the stomach was in any way connected with the intussusceptions. Their presence however, taken in connection with the tympanitic state of the abdomen noticed during the time the patient remained in hospital, and with the distension of the stomach found at the *post-mortem* examination, makes the case a very remarkable one." Dr Giraud, in his account of Datura poisoning, quoted by Chevers (*Indian Medical Jurisprudence*, page 839) states,—"In four cases (of datura poisoning) I have met with deep coma, with insensibility, stertorous breathing, and in two of these there was a remarkable tympanitic state of the abdomen."
Bombay	1873	......	4	......	....
Do.	1874	......	9	......	"In most of the cases it seems to have been given with the object of producing stupefaction for purposes of robbery, and in one case, from what I could learn, it was placed in food with the design of getting up a false charge of drugging. In none of the suspected cases could I succeed in detecting it in the viscera." * * * This leads me to notice the fact mentioned in the last report of the Chemical Examiner at Calcutta, that the testa of a datura seed resembles that of capsicum so closely that it is in most cases impossible to distinguish them. This is quite true. A good deal has been said in favour of what was called the peculiar appearance of the testa of datura seeds under the microscope as reliable evidence of their presence. Knowing that capsicum, a member of a closely-allied genus, was a common constituent of native food, I took the trouble to compare it microscopically with datura, and finding the testa or outer covering of both seeds so nearly similar in appearance, I long since discarded the microscopic test for datura, preferring in all cases to rely only on its physiological action as the proof of greatest value."

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
Bombay—(*contd.*) ...	1875	1	8	......	"The poison was detected in 9 cases, or the same number as last year; four of these nine cases came from the Central Provinces and Berars. The nine cases included the poisoning of no less than twenty individuals; only one death from the effects of the poison is however recorded. In all nine cases the poison seems to have been administered in food or sweetmeat, but with what object is not stated. In most of the cases, apparently, robbery was the object in view. In one however from Akola, in which the alkaloid was extracted from some food which had been partaken of by a man, who thereafter suffered from symptoms of datura poisoning, it is reported that the food in question was prepared by his wife. The following is the history of the single fatal case of poisoning by this drug above alluded to:—A family consisting of two men, their wives, and an old woman, their mother,—in all five persons,—lived in a hut in a lonely part of the Thar and Parkar District in Sind. One evening a man brought them some sweetmeat, of which all five proceeded to partake, but noticing that it had a bitterish taste, desisted after eating a small quantity. Twelve hours afterwards four of the five persons were found delirious, and suffering from the usual symptoms of datura poisoning, and the old woman was found dead. The alkaloid was eliminated from the contents of the stomach of the deceased. An attempt also was made to extract it from the liver, but without success."

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					"Out of twenty persons, therefore, who suffered from symptoms of datura poisoning, only one died, and this was an old woman with a constitution probably weakened by age, and less capable of withstanding the effects of the drug. This seems to be the usual experience as to the mortality from datura poisoning among the cases before the Bombay Chemical Analyser. As a rule, the cases are not fatal. Every now and then, a fatal case occurs, and then it is found that the individual is either very young or advanced in years, or suffering from some disease. Fatal cases in healthy adults seldom occur. Possibly one reason of this small mortality among cases of datura poisoning may be due to the fact that the poison is generally given to facilitate robbery and not with any idea of causing death. It is curious, however, that the experience of datura poisoning in some other parts of India should show a far greater mortality than this. Dr. Burton Brown, of Lahore, quoted by Taylor and Chevers, speaks of a mortality of twenty-one cases out of ninety-two, or 22·8 per cent. On the other hand, Dr. Giraud records 51 cases of datura poisoning admitted into the Jamsetjee Jejeebhoy Hospital, Bombay, in 1848, without a single death."
Do.	1876	1	13	......	"The poison was detected in 14 cases as compared with 9 in each of the two previous years. The reports sent, record only that 5 persons were attacked with symptoms of datura poisoning; probably a much larger number of persons than this suffered, the reports sent with many of the cases being silent as to whether any individuals were poisoned or not. Two deaths from datura are included in the 14 cases. One of these was a case from Baroda; in this case, although the alkaloid was not detected in the viscera of the deceased, a powder of which the deceased made some pills and swallowed them some hours before death, was found to consist of powdered datura seeds. The other fatal case was that of a child poisoned by the

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					alkaloid. In this case, a child two years old, got hold of a small pill box in which a small quantity had been kept for use in ophthlamic practice by its father. Shortly afterwards it became insensible and convulsed, the pupils became widely dilated, and death took place with well-marked symptoms of datura poisoning. Another case which may be specially mentioned was the subject of a trial before the High Court, Bombay; this was a case of dragging in order to facilitate theft. A man while travelling by rail to Bombay, got into conversation with some fellow travellers, and accepted *pan-supari* from them; they on arrival took him to a house where he became insensible and was robbed; a portion of a powder said to have been given to complainant with the *pan-supari* was found to consist of powdered datura seeds. In 7 of the 14 cases, the identification of the poison depended on the extraction of the alkaloid; in the remaining 7 cases, the extraction of the alkaloid was not required, whole datura seeds, sufficiently perfect for identification, being present in the matter vomited and submitted for examination."
Bombay—(*contd.*) ...	1877	2	12	......	In seven cases the seeds were found, and in seven the poison was identified by its physiological action.
Do.	1878	......	......	......	"Twelve cases in which datura was detected were referred during the year. These 12 cases included the poisoning of 17 persons, of whom eight died. In many of the cases

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the drug seems as usual to have been administered in order to facilitate the commission of theft. Thus in a case from Gadag, the history is as follows:—Two merchants started with a *tattoo walla* (pony man) from Hubli to buy cotton in the neighbouring villages. As they were starting a man and a woman offered themselves as guides, stating that they would show them the villages where cotton was to be had. At a halt, food was prepared by the woman, of which the merchants and the *tattoo walla* partook. All these became insensible and were robbed. One of the three died. Again in a case from Dholka, two women were poisoned with datura in sweetmeat; both died. The motive, in this case also, it was stated, was the facilitation of theft. The third case from Karmala was a case in which some thieves gave a powder, afterwards found to contain powdered datura seeds, to a cartman, and while he was insensible, robbed him. This case also terminated fatally. Probably, also, facilitation of theft was the motive in a case from Bhusaval, where a man was taken in a state of insensibility out of the Jubbulpore down mail. It was stated that he had been insensible for 16 hours. He died shortly after admission into hospital. A fellow-traveller of deceased confessed to having administered datura to him in some *gram* (chickpeas) and *dhall* (pulse) which he had given him to eat. In four other cases, where persons were poisoned with datura, the motive for the crime is not stated in the history of the case. In each of these cases, three persons were poisoned. In two of the cases the victims recovered, in the third all died. In the fourth case one individual was poisoned and recovered. In the remaining four cases possibly, also, persons were poisoned, but no statement to that effect accompanied the matters sent for examination. In two of these cases the substances forwarded were powders containing datura seeds. In a third case the alkaloid was found in some sweetmeat, and in the fourth case some sediment left in a

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
					bottle, sent by the Poona City Magistrate, was found to contain the alkaloid. Although in the great majority of cases of poisoning by datura, the motive, as already stated, is to facilitate robbery, every now and then cases come under notice, where, from the poverty of the victims, it seems impossible that this could have been the case. In the town of Bombay, for example, some few years ago, beggars used constantly to be brought to the Jamsetjee Jejeebhoy Hospital, suffering from the symptoms of datura poisoning. It is possible that such cases may be explained in this way. I am informed that it is a popular belief that the utterances of persons, under the influence of datura, are oracular, and may be depended on as a guide to the success of undertakings, &c. It may be, therefore, that this is the solution of cases in which from the poverty of the persons poisoned, it is impossible that theft could have been the motive for administration of the drug."
Bombay—(*contd.*) ...	1879	......	......	......	"Nine cases of poisoning by datura were referred during the year. These 9 cases embraced the poisoning of 19 persons, of whom 3 died. In 5 of the 9 cases more than one individual was poisoned. Of these 5 cases, one came from Gadak; in this case 4 men were poisoned, and a second case in which two men, both of whom died, came from Kaira. The other three cases were sent up by the Bombay Police, and appear all to have been cases of drugging for the purpose of facilitating commission of theft. In one of

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					these three cases, two persons—a man and a woman,—were poisoned, and in the third case, 4 men were poisoned. In the second of these Bombay cases, the only one of the three in which a death occurred, the amount of property stolen was considerable, its value being estimated at Rs. 2,500. The persons poisoned were two Punjabee merchants and their servant, and the individual suspected was a man whom they had engaged as a servant, and whom they had met while on their journey to Bombay. The third case occurred on the board the P. and O. S. S. *Surat*, the individuals poisoned being two native passengers and two of the native crew. Of the 4 cases in which one person only was poisoned, one was also a Bombay case, and was a case, in which a prostitute, it was alleged, was drugged with datura, and then robbed of her ornaments by some men. A second case came from Kaira, and was one in which a man was poisoned by datura, his wife being the party suspected to have administered the poison. A third case was forwarded from Kaladgi; in this case a man was poisoned, datura seeds being found in the food which he had eaten, and also in a packet discovered in the house of the person accused. And the fourth and last case was forwarded by the Civil Surgeon of Satara; in this case a child was poisoned, the poison having been given in *goor* (coarse sugar)."
Do.	1880	2	6	......	"Eight cases in which datura was detected came under notice during the year, embracing the poisoning of 22 individuals, of whom two died. Enumerating these cases in the order in which they were received, the first case in the list was one from Sukkur, where 7 Mahomedans were, it is alleged, poisoned with datura at a Holi feast by some Hindus. Next we have a case from Shripur, where three men were poisoned by datura given to them in bread. The third case came from Ling Saugor, Hydrabad Assigned Districts, and was one in which two sweepers, of whom one died, belonging to a native regiment, were

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					poisoned by datura. The man who died, only lived, it is said, for 2 hours after taking the poison. The fourth case came from Borsad; in this case two men and a girl were poisoned, one of the men died 7 hours after taking the poison; the other two individuals recovered. In the fifth case from Poona, several boys were poisoned by some sugar given to them, which, on examination, was found to contain powdered datura seeds. In the sixth case from Karachi, the active principle of datura was detected in some cooked food forwarded for analysis. No history of this case was furnished to this office. The seventh case was from Jacobabad; in this case, two men were poisoned by datura, it was alleged, by a third, who afterwards robbed them; and lastly, the eighth was one from Borsad, in which a man complained to the Police that some one had put datura into his food; a portion of the food in question sent for examination was found to contain datura seeds."
Bombay—(*contd.*) ...	1881	.....	2	.....	"The two cases in which datura was detected during the year under report were as follows:—1. A case from Poona, in which a quantity of datura seeds were found in the possession of a man charged with the offence of drugging with a view to facilitate the commission of theft; and 2. A case from Sukkur, in which the active principle of datura was detected in some food which had been partaken of by three men, who thereafter suffered from symptoms of poisoning by datura."

Do. ………………	1882	……	4	……	(a) Poisoned at a feast; (b) Poisoned by his wife; (c and d) No particulars forwarded with the poisoned food.
Do. ………………	1883	1	5	……	"This poison was detected in 5 cases; in two, from the history, the poison appears to have been given for the purpose of facilitating the commission of theft. One of the cases was forwarded from Sorath in Kathiawar, and was a case in which 3 persons were drugged and afterwards robbed,—all three recovered. The other case occurred in Bombay, and was as follows:—The body of a man was found in a tank on the Esplanade with the feet tied together. *Post-mortem* examination of the body of the deceased indicated drowning to be the cause of death. Ornaments which deceased had been wearing a few hours before death were missing, and subsequently traced to the possession of two men in the company of whom deceased had been seen on the evening of his disappearance. On analysis atropine was found in the contents of the deceased's stomach, and one of the two accused is alleged to have stated that he had seen his companion put a powder into some liquor which he gave to the deceased. In 2 other cases, respectively, 6 and 5 persons appear to have been poisoned; in the first mentioned of these 2 cases (from Wadhwan) 3 of the 6 persons poisoned died. The history of these two cases is silent as to the motive for the crime. Lastly, in a case from Karachi, 18 Fakirs, all of whom recovered, were poisoned by datura given to them in sweetmeats. In this case also the history of the case does not throw any light on the motive for the crime."
Do. ………………	1884	……	4	……	Involving ten persons—(a) Two, both recovered; (b) Do. (c) Three, all recovered; (d) Three, two recovered and one died.
Do. ………………	1885	……	5	……	"The following is a summary of the five cases—all non-fatal, in which this poison was detected during the past year:—(1) In a case from Belgaum several persons—precise number not stated—suffered from symptoms of datura poisoning after eating food prepared from flour found, on examination, to contain the alkaloid of datura.

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					The accused in this case confessed to having mixed powdered datura seeds with the flour. (2) In a case from Bagevadi (Kaladgi District), the alkaloid was found in some sweetmeat given by one man to another, who, after partaking of it, was attacked by the usual symptoms of datura poisoning. The motive in this case was stated to be to make the poisoned individual 'mad on account of kept woman.' (3) In a case from Broach, a woman confessed to having put powdered datura seeds in her husband's food. The husband and 'others' who ate of the poisoned food were attacked. Datura seeds were found in accused's possession and identified. (4) In a case from Satara, in which five persons—two of them children—were poisoned, the alkaloid *daturine* was found in some fragments of breadcakes, some flour sent at the same time and said to be a portion of the flour from which the bread in question was made, was found to be free from poison. (5) Lastly, in a case from Hubli (Dharwar District), three children were poisoned, and datura seeds, whole and in powder, were found in possession of the accused. Some powder scraped from a grinding stone belonging to the accused was also found to contain the alkaloid.
Bombay—(*contd.*) ...	1886	......	4	......	All non-fatal, seeds identified.
Do.	1887	2	4	......	"The poison was detected in 5 cases during the year. In each of the 5, individuals were poisoned, and in 1 case there were two deaths. A summary of the 5 cases is as

					follows :—(1) A case from Sanand (Ahmedabad District), in which datura seeds were found in the contents of the stomach of each of two men, who suffered before death from symptoms of datura poisoning. (2) A case from Jalgaon (Khandesh District), in which some seeds found in the possession of a woman accused of poisoning 4 men with datura, proved, on examination, to be datura, seeds. (3) A case from Dakor (Kaira District), in which the active principle of datura was detected in some food. A portion of this food had been eaten by 4 persons, who, thereafter, were attacked with symptoms of datura poisoning—all recovered. The sufferers in this case were a man, his brother's wife and two servants. (4) A case from Belgaum in which some dregs taken out of a coffee-pot were found to contain atropine. In this case it was reported that a man and his family—number not stated—suffered from symptoms of datura poisoning after drinking coffee prepared in the pot from which the dregs had been taken. (5) A case from Karachi, in which atropine was extracted from some cooked rice. 8 persons, it was reported, had suffered from symptoms of datura poisoning after eating some of the rice sent for examination."
Do.	188	......	5	......	"5 cases of poisoning by this drug were reported during the year. In all five the alkaloid was detected in food which had given rise to symptoms of datura poisoning, *viz.*, in 1 case in bread, in 2 cases in flour, and in 2 cases in cooked vegetable food. In 1 of the 5 cases from Amraoti (Berars), the victims, it was stated, were 4 in number, and in another from Sorath (Native State), 2 persons, a man and a girl, were the sufferers. In each of the other 3 cases one person only was poisoned, the victim in each case being a male adult. Of these 3 cases 2 came from Anand (Kaira) and 1 from Haveli (Poona District). In 1 of the 2 cases from Anand the victim died. This was the only fatal case of poisoning by datura reported to this office during the year."

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	REMARKS.
Bombay—(*contd.*) ...	1889	2	3	......	"Three cases of poisoning by this drug were forwarded for investigation during the year under report. The cases were :—A case from Uran (Thána District), in which two women had displayed symptoms of datura poisoning after partaking of some bread, but recovered upon treatment. Datura was found in the vomit and also in the bread. (2) A case from Dholka (Ahmedabad District), in which datura was detected in the viscera of a man who had been poisoned; datura seeds were found in the stomach of the deceased, and also adhering to a stone which the accused had used for pounding the seeds. (3) A case from Malegaon (Nasik District), in which a child, after eating some sweetmeat given to it by a neighbour, had exhibited narcotic symptoms and eventually died. Datura seeds were found in the contents of the stomach of the child."
Do.	1890	2	2	......	"These 4 cases include the poisoning of thirteen persons :—(*a*) A case from Haveri (Dharwar), in which 8 persons, after eating food, exhibited symptoms of datura poisoning, all recovered. (*b*) A fatal case from Tanna, no history forwarded. (*c*) A fatal case from Borsad (Kaira), no history. (*d*) A case in Bombay in which a brass-pot, containing datura seeds, was forwarded for examination; this case was in connection with the poisoning of 3 women who were treated in hospital; all recovered.

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Madras	1855	1	......	......	
Do.	1868	1	......	......	......
Do.	1870	1	......	......	......
Do.	1871	1	......	......	......
Do.	1874	1	......	......	......
Do.	1875	1	......	......	......
Do.	1878	1	......	......	......
Do.	1879	2	2	......	......
Do.	1880	1	1	......	......
Do.	1881	3	1	......	......
Do.	1882	1	2	......	......
Do.	1883	2	......	......	"Datura was detected in viscera only once. It was found once in some pills, and once in a powder, both of which were supposed to have been used with criminal intent."
Do.	1884	7	4	......	...... "Datura was discovered in 8 cases, some of which are worthy of record:—(*a*) Madura. The deceased man was supposed to have been drugged and thrown into a tank while in an unconscious state. The poison is believed to have been given in milk. Another man who partook of the suspected milk, suffered from vomiting and a bitter taste in the mouth, and is reported to have been delirious, clutching at imaginary objects for three days." "(*b*) Madura. Two men were drugged by poisoned milk while travelling by the South India Railway. One of them remained unconscious for two days. Both recovered. In this case a suspected powder was submitted for examination. No results were obtained with the alcoholic extract, but the alkaloid extracted by the Stas' process produced the physiological effects of datura." "(*c*)"Godaveri.—Three boys suffered from vomiting, tingling of the skin, delirium and clutching at imaginary objects shortly after taking some toddy. Datura was found in the vomited matters." "(*d*) Kistna.—After drinking arrack, three persons were affected with vomiting, delirium, and dilated pupils. Datura was found in the arrack.

Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					"(e) Bellary.—Powdered leaves of *Datura fastuosa* were administered as an aphrodisiac." "Fourteen individuals were poisoned by datura, but in no case does a fatal result appear to have been due to the drug. The only death seems to have occurred from drowning while the victim was under the influence of datura.
Madras—(*contd.*)	1885	4	2	......	Datura was detected in three cases:—(*a*) 4 persons were attacked with characteristic symptoms half an hour after taking food. (*b*) 6 persons were said to have suffered from the usual symptoms soon after taking food; datura seeds were discovered mixed with chilli seeds in the evacuations. The seeds were identified by their structural peculiarities, but no physiological effect could be obtained with them; they were apparently exhausted by maceration during their passage through the intestinal canal.
Do.	1886	2	2	......	Datura was found in 4 cases:—(*a*) A female traveller put up at a certain house. Soon after a meal, the seven inmates, not the traveller, were seized with giddiness, thirst, tingling in the throat, delirium and stupor. Evidence of datura was found in pepper water, and in a fragment of a cooking pot. (*b*) 23 persons, after a meal, were seized with symptoms of datura poisoning; all recovered. The alkaloid was found in the vegetable curry and in one parcel of vomit. (*c*) A suspected abortifacient drug consisted of datura seeds.

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Do.	1887	......	......	......	....
Do.	1888	1	3	......	Atropine was detected in three cases. The heading now includes cases in which no part of the plant used is available, the identification resting upon the discovery of a midriatic alkaloid; they were formerly included under "Datura."
Do.	1889	3	1	......	Datura and atropine were found in four cases alone, and mixed with ganja in one case. (*a*) Three chucklers, who were in the habit of stealing toddy off the trees, became more than usually intoxicated on one occasion, and one of them, who drank a larger quantity than the others, became insensible and died. Atropine was extracted from his stomach and from the toddy, in which were also found datura seeds. (*b*) In another, a woman committed suicide, owing to a quarrel with her husband, by eating the datura fruit; the seeds were found in her stomach, from which also the alkaloid was obtained. (*c*) Four persons became delirious after eating a pudding, and one of them became insensible and died; from the deceased's stomach atropine was extracted.
Do.	1890	......	6	......	Datura and atropine were detected in five cases alone, and together with arsenic in a sixth case. In the three cases of atropine no parts of the plant could be obtained, and only a midriatic alkaloid was extracted from the articles sent; while in the three cases returned under datura, some part of the plant was also available for identification. (*a*) Two persons after eating a morning meal, were affected with delirium, incessant talking, twitching of muscles, clutching at imaginary objects, fits of laughter, difficulty of swallowing, and dilatation of pupils. A magician, who was sent for to discover the cause of these symptoms, unwisely ate some of the food as an experiment and suffered similarly. In the meantime 6 other members of the family to whom food was sent out to the fields were found suffering in the same way, and one of them died. (*b*) Two brothers-in-law put datura seeds into the curry of three women, who were their neighbours, with malicious

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle-poisoning cases.	Remarks.
					intent, and were sentenced to 2 months' rigorous imprisonment. (c) A Bengali traveller joined a party of Mahometans who had returned from Mauritius, and were making their way down from Calcutta to Vizagapatam. On the way the Bengali contrived to poison his companions with datura, with the intention of robbing them, but he was foiled in his scheme, and was sentenced to 7 years' rigorous imprisonment.
Punjab	1862	......	......	......	Datura was detected in 4 instances; no further information available.
Do.	1863	......	......	......	Do. in 1 instance do.
Do.	1864	......	......	......	Do. in 3 instances do.
Do.	1865	......	......	......	Do. in 9 instances do.
Do.	1866	......	......	......	Do. in 7 instances do.
Do.	1867	......	......	......	Do. in 6 instances do.
Do.	1868	......	......	......	Do. in 6 instances do.
Do.	1869	......	......	......	Do. in 14 instances do.
Do.	1870	......	......	......	Do. in 7 instances do.
Do.	1871	......	......	......	Do. in 15 instances do.
Do.	1872	......	......	......	Do. in 9 instances do.
Do.	1873	4	16	......	"Datura is principally used by robbers to cause insensibility, and, indeed, no poison could be better adapted for the purpose, as in ordinary cases the victim rapidly becomes intoxicated, throws off his clothes and picks up dust and straw, and afterwards remains for some time in a state of idiocy or forgetfulness, that makes him unfit to give

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proper evidence, till the criminals may have made their escape. This state sometimes lasts for days, and is then probably due to whole seeds being swallowed, which, if not expelled by vomiting, may take some time to pass through the whole intestinal canal. Being extremely tough, they are not wholly dissolved or digested, and in one case in hospital whole seeds were found in the fæces. In cases of suspected datura poisoning the intestine should be therefore sent along with the stomach. In 3 fatal cases the whole seeds were found in the stomach; in 1 fragments were found. In 2 specimens of vomit, whole seeds were found; in 2 others, fragments.

"The articles of food in which it was detected were cooked rice and *dall* (pulse), in which it had been put with capsicums which it rather closely resembles, and in 1 case in sweetmeats along with almonds and other seeds.

"Among the drugs, it was found in one case pounded and made up in pills; in 2 in powders with aromatics, in 1, in a *masala* for food; in 1, adhering to a pestle and mortar; in 1 case it was mixed with tobacco; in the rest seeds or the pounded seeds were sent for identification. In all these cases, except 2, the examination for datura poisoning was made on account of suspicious seeds or fragments being found in the physical examination. When fragments were found they were identified by their microscopic characters, and the active principle was extracted and dropped into a cat's eye, causing dilatation of the pupil."

Do.	1874 1875 1876 1877 1878	Not available.

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Presidency.	Year.	Human viscera.	Substances suspected to be or to contain poison in connection with human poisoning cases.	Substances suspected to be or to contain poison in connection with cattle poisoning cases.	REMARKS.
Punjab—*contd.*	1879	3	16	......	"Datura, the Thug poison, is almost always used to facilitate robbery. It not unfrequently causes death, as will be seen from the statistics. Three of the cases referred ended fatally, and two of these were sent up as cases 'found dead,' the Civil Surgeon being unable from the *post-mortem* appearance to certify the cause of death, and forwarding the viscera as a precautionary measure."
Do.	1880	4	22	......	"In the non-fatal cases (in which vomit or excreta were sent) datura was detected in 15 instances; while datura seeds, powdered, were found in 6 cases in food and once in drugs."
Do.	1881	12	26	......	In the non-fatal cases datura was detected in 8 instances in vomited matters; in 13 instances in food articles and drugs.
Do.	1882	2	16	......	In the non-fatal cases datura was detected in 5 instances in the excreta, in 9 instances in food and in 2 in the drugs forwarded.
Do.	1883	3	14	......	Datura was detected in 6 instances in vomited matter, in 6 in food articles, and in 3 in the drugs forwarded (non-fatal cases).
Do.	1884	1	21	......	Datura was detected in 10 instances in vomited matters, in 6 in food articles, and in 3 in the drugs forwarded (non-fatal cases).
Do.	1885	2	14	......	Datura was detected in 5 instances in vomited matters, in 6 in food articles, and in 3 in the drugs forwarded.
Do.	1886	2	12	1	Datura was detected in 1 instance in vomited matters, in 6 in food articles, and in 5 in the drugs forwarded.

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					In connection with cattle poisoning cases, datura was detected in 1 instance mixed in a ball of *atta* (flour).
Do.	1887	2	3	......	Datura was detected in 2 instances in food articles, and in 1 instance in the drugs forwarded.
Do.	1888	4	......	......	....
Do.	1889	7	54	......	....
Do.	1890	Not available.		......	....

The following cases of Dhatura poisoning have been recorded by Dr. Brown in his book ("*Punjab Poisons*"):—

"Case No. 23.—Extracted from the Indian *Lancet* of August, 1st, 1860, reported and treated by Dr. Aitchison:

"Busunki, aged 35, employed as a Chaudari, had been ill for some time with a cough for which he went to a native hakim, and on November 23rd, 1859, at 8 a. m., he took some medicine; on arriving at his own house about half an hour afterwards, he complained of headache and feverishness, and went about nearly naked; he was also restless, moving about from place to place, and was attacked by convulsive fits.

"He was seen at half past seven in the evening, at which time he was in a state of unconsciousness, with greatly dilated pupils. He continued in a state of restless delirium, incessantly tossing his head from one side to another. The pulse was slow and the mouth dry.

"He vomited after an emetic was given, and then began to stare about and talk deliriously; afterwards he had two convulsive fits in which he foamed at the mouth.

"The next morning he was less delirious, and the pupils were natural. He remained unconscious till the 3rd day, and then recovered his senses, but he became weaker; and on November 28th, five days after he had taken the poison, he died from exhaustion. On enquiry it was found that he had never had any fits before this illness. The patient was treated at first with emetic of mustard flour and hot water, afterwards cold affusion was applied to the head and Carbonate of Ammonia administered internally as a stimulant. On the second day castor oil was given as a purgative."

"No. 24.—Case No. 75 of 1866, Punjab Records.—A man visited a house while food was being cooked; he left suddenly and the three persons who partook of the food were taken ill and one died. Dhatura seeds were found in the food, and also on the person of the man, who was sentenced to death."

"Case No 25.—Gogaira, January 1860.—A man named Furida went to th[illegible] of Mussammat Hatim one evening, while her husband was absent, and took an opportunity of mixing some dhatura seeds wi[illegible] rice that she was cooking, as he afterwards confessed. Mussammat Hatim, another woman, and an old man partook of the rice when [illegible] cooked, but the poisoner refused to do so. Shortly after eating, Mussammat Hatim was attacked with extreme giddiness, and her mouth and throat became very dry, and subsequently she became insensible as did also the other two.

"The next morning the two women were seen to rush from the house in a very excited manner, tearing off their clothes till they were almost naked, and throwing about bricks like mad people. On entering the house, the old man was found insensible, lying on his bed and clutching at it; his breathing was loud and as if his throat was filled with phlegm; he was perfectly unconscious and remained so for three days. The two women recovered on the second day, one of them declared that she had been raped while insensible.

"An infant also partook of a portion of the food and became insensible. Seeds of dhatura were found on the prisoner, who alone was quite unaffected by any illness."

"Case No 26.—Another very interesting case in which death occurred happened at Umballa in 1861. A man named Din Muhammad was sent with some money to Umballa; on his way he met with a person named Devera, with a companion. These persuaded him to drink some liquid which they had mingled with pounded datura seeds, as they afterwards confessed.

"Shortly after Din Muhammad had drunk this, he complained of feeling thirsty and confused. He was seen to stagger about as if drunk, and then to fall and become senseless. From this condition he was roused by pouring cold water over his head; he then got up and began to roam about like a mad man and to strip off all his clothes.

"Afterwards he ran up a tree and jumped off into thorns, and then began to run about laughing and singing, and to eat earth. Subsequently he fell down and died, vomiting before death"

"Case No. 26.—Lahore, November 2nd, 1859.—Lulloo had been married to Kirpoo for 14 years without having any children. He therefore asked Muhammad Shah to give them some medicine which would produce fertility. This was done at their own house, while they and the poisoner were alone present. Half an hour afterwards the male sufferer felt his head going round, and subsequently he became insensible, as also did his wife. They were found by the man's brother in an insensible state, and the woman remained so for three days, and then died, but the man recovered.

"The prisoner confessed that he had given dhatura."

"Case No. 27.—This case happened at Kasauli in the Punjab, and was investigated there on the 24th August 1860. From the evidence it appeared that Ballu, a Brahmin, was travelling with his brother and some cartmen, and also another Brahmin, named Sadanand; that on July 21st, the last person prepared a dish called *chori* made of *chuppaties* (cakes) and sugar, of which the two brothers ate rather largely, the cartmen sparingly, and the prisoner Sadanand not at all. Very shortly afterwards the two brothers were taken ill and became insensible; the cartmen appeared also as if intoxicated, but the prisoner was not affected. Ballu died the next day, remaining insensible up to the time of his death.

"The prisoner confessed that he had ground dhatura seeds to powder, and mixed them with the food. In consequence none were detected on examination of the contents of the stomach of the deceased, but this was found to be very much inflamed."

"No. 28.—Case No. 112 of 1862, Umritsar.—Two men became insensible after eating some *dhall*; they remained so for several hours, but ultimately recovered. A large quantity of white dhatura was found in the *dhall* left."

"No 29.—Case No 5 of 1869, Hissar.—Three persons began to suffer from thirst, dryness of the mouth, and vomiting half an hour after taking some food; they then became drowsy and delirious; the pupils of the eyes were seen to be dilated; they remained delirious for two days and nights and then recovered. Dhatura seeds were found in the sugar which they had eaten."

"No 30. Case No 27 of 1868 from Panjab Records for 1868.—Some travellers leaving Lahore were joined by a stranger, who supplied them with *atta* and two of them also took some native liquor from him: they soon became ill, and appeared like drunken men: they were taken to Umritsur and treated for poisoning by dhatura. One man who had taken the spirit died in a few days, the rest recovered. No dhatura was found, and the prisoner was acquitted."

"No 31.—Case No. 38 of 1869, Jullunder.—Five persons of the same family became insensible after taking some food and remained so for 24 hours, after which they recovered, but their pupils were seen to be dilated. Dhatura seeds were found in the vomited matters."

"No 32.—Case No. 12 of 1876, from the Panjab Records for 1876.—The accused confessed that he had administered dhatura to his wife, as he said, to frighten her. She and another woman partook of the food into which the poison was introduced, and both became intoxicated and suffered from vomiting and purging, but recovered. The accused was sentenced to 2½ years' rigorous imprisonment, but no compensation was awarded to the sufferers."

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"No 33.—Case No. 31 of 1870, Delhi.—Five persons partook of food together, but all complained of a peculiar bitter taste, and one hour afterwards they were all attacked by headache and giddiness. They all became stupefied, but complained of cramps and twitchings of the limbs. They were unable to stand, but fell down and kept on rolling about. They all vomited, and then recovered. Dhatura seeds were found in the vomited matters."

"No. 34.—Case No. 121 of 1870, Lahore.—A Sikh ate some *dahi* (curdled milk). Half an hour afterwards, he began to be delirious and threw off his clothes; he vomited and gradually recovered. Dhatura seeds were found in the vomited matters."

"No. 35.—Case No. 130 of 1868, Muzaffargarh.—A man became insensible in less than one hour's time after drinking some buttermilk, and died in 8 hours. Dhatura seeds were found in the milk."

"No. 36.—Case No. 205 of 1869, Karnal.—Two men partook of some *Majun** with which dhatura seeds had been mixed by a third man, who afterwards confessed it. Both the men became insensible, and were conveyed to the hospital, where they were found to be in a state of complete coma with dilated pupils and stertorous breathing; no pulse could be felt at the wrist, and both soon died. Dhatura seeds were found in the stomach of each of them."

"No. 37.—Case No. 61 of 1886, Umballa.—A woman and a child became delirious after eating some food, but both vomited, and then recovered. Dhatura seeds were found in the food in poisonous quantity."

"No. 38.—Case No. 111 of 1866, from Hissar.—A poisoner was reported to have killed at least 15 persons, as he was in the habit of giving poisoned sweetmeats to travellers who afterwards became insensible and many died. Dhatura seeds were found in a little bag in his clothes."

An account of 32 cases of dhatura poisoning was given by Assistant-Surgeon Nil Ratan Bannerjee in the *Indian Medical Gazette* for 1885, page 209. All but four recovered.

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* A kind of sweetmeat.

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SCOPOLIA LURIDA, *Dunal.*

Fig.—*Link & Otto Ic. Sel., t.* 35; *Miers Ill. S. Amer. Pl. II., t.* 78; *Sweet Brit. Fl. Gard., t* 125.

Hab.—Central Himalaya, Nepal, Sikkim.

History, Uses, &c.—The properties of this plant do not appear to be known to the natives of India. It was introduced into Europe as a garden plant by the late Mr. Whitley of Fulham in 1823, and is of the most easy culture, and will grow in any soil, but requires a dry situation. (*Loudon.*) In the *Pharmacopœia of India* it is stated that a tincture prepared from the leaves, in the proportion of one ounce to eight ounces of alcohol, administered to different patients, was found to produce extreme dilatation of the pupil; and in two instances it induced blindness, which only disappeared when the medicine was discontinued. The largest dose given was 20 drops of the above tincture during the twenty-four hours. (*Op. cit. p.* 181.) These experiments were reported in the *Gaz. Med. Nov.* 4th 1843) and appeared in *Braithwaite's Retrospect of Med. IX.*, p. 119. Of late years other species of Scopolia, especially *S. japonica*, have attracted attention in Europe as substitutes for belladonna.

Description.—*S. lurida* is a strong, robust, downy, canescent plant, with something the habit of Belladonna, and solitary, drooping, lurid yellow or greenish-purple flowers. The leaves resemble those of Datura. The fruit is globose, about $\frac{3}{4}$ inch in diameter, circumsciss above the middle, lid one-celled, remainder two-celled; seeds numerous, reniform, granulate, $\frac{1}{12}$ inch.

Chemical composition.—*S. lurida* has been examined by Siebert. (*Archiv. der Pharm. Feb.* 20, 1890, *p.* 145.) From flowering plants he reports that he obtained, by fractional precipitation of an acidulated liquid with gold chloride, a "not inconsiderable quantity of hyoscyamine," but no atropine or hyoscine, while from plants collected when the seed had ripened, only a very small quantity of atropine could be isolated under the same conditions and no hyoscyamine. The failure to detect hyoscine is thought to be possibly due to insufficiency of the material used. These results seem to indicate that the degree of development of the plant may have an important relation to the quantity and nature of the alkaloids occurring in it. (*Pharm. Journ. Mar.* 1*st*, 1890, *p.* 709.)

HYOSCYAMUS NIGER, *Linn.*

Fig.—*Bot. Mag., t.* 2394; *Bentl. and Trim., t.* 194; Henbane (*Eng.*), Jusquiame noire (*Fr.*).

Hab.—Temperate Western Himalaya. Cashmere to Gurhwal.

HYOSCYAMUS MUTICUS, *Linn.*

Fig.—*Jaub. et Spach. Ill.* v., *t.* 415; *Griff. Ic. Pl. Asiat., t.* 412. Syn.—*H. insanus*, Stocks.

Hab.—West Punjab, Sind, Afghanistan.

HYOSCYAMUS RETICULATUS, *Linn.*

Fig.—*Commelyn Hort.*, 77, *t.* 22.

Hab.—Beluchistan, Badghis, Khorasan. The herb and seeds.

Vernacular.—Khorasáni-ajowán (*Hind., Beng.*), Khorasáni-ova (*Mar.*), Khorasáni-ajamo (*Guz.*), Kúráshání-yomam (*Tam.*), Kúrásáni-vámam (*Tel.*), Khurásáni-vádakki (*Can.*),

History, Uses, &c.—Henbane, though a native of the Himalayas, was probably unknown to the ancient Hindu physicians. Parasika and Khorasáni yamáni, the names which it bears in some recent Sanskrit works, indicate its foreign source. Three kinds of ὑοσκυάμος were known to the Greeks, μελας, black, λευκος white, and μηλοειδης. yellow. Hyoscyamus is called Altercum and Herba symphoniaca by Latin writers. Cf. *Pliny*, 25, 17, who states that altercum is its Arabian name. It is probably a corruption of الترياق originally a Persian word signifying an "antidote," in Greek θηριακα. In Palladius and other late writers we meet with the mutilated form Jusquiamus. Mahometan writers call it Banj, an Arabic corruption of the Persian Bang; they say it is the Afiyun (ὄπιον) of the Greeks, the Azmálús of the Syrians, and the Katfít or Iskírás of the Moors; they also add that in the Deilami language it is called Kír-chak, because the capsules resemble a little basket with a cover, such as the Arabs make out of date leaves and call Kafír. Baron Hammer-Purgstall makes the following important observation: *Bendj*, the plural of which in Coptic is '*nibendj*,' is without doubt the same plant as the '*nepenthe*,' which has hitherto so much perplexed the commentators of Homer. Helen evidently brought the nepenthe from Egypt, and bendj is there still reputed to possess all the wonderful qualities which Homer attributes to it." (*Trébutien "Contes Inédits des Mille et une Nuits*," i, p. 12, note.) Mír Muhammad Husain's description of Banj in the *Makhzan* agrees well with the genus Hyoscyamus. He says there are three kinds—white, black, and red, and that the white is to be preferred; he mentions the preparation of a sun-dried extract from the juice of the fresh leaves, and says that the leaves are also pounded and made into a paste with flour, out of which small cakes are formed, which when dry retain their medicinal properties for some time. Henbane is described by Eastern writers on Materia Medica as intoxicating, narcotic and anodyne; among the many uses to which it is put the following may be mentioned as now peculiar to the East. A poultice of the juice with barley flour is used to relieve the pain of inflammatory swellings. The seeds in wine are applied to gouty enlargements, inflamed breasts, and swelled testicles. About half a drachm of the seeds with 1 drachm of poppy seeds is made into a mixture with honey and water, and given as an anodyne in cough, gout, &c.* Equal parts of the seeds and opium are said to be a powerful narcotic. A mixture of the powdered seeds with pitch is used to stop hollow teeth which are painful, and also as a pessary in painful affections of the uterus. The juice or a strong infusion of the seeds is dropped into the eye to relieve pain. Lastly, the seeds made into a paste with mare's milk and tied up in a piece of wild bull's skin if worn by women, is said to prevent conception. Ainslie and other European writers upon Indian Materia Medica notice the use of Hyoscyamus seeds in India.

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* Compare with Scrib. Comp. 89 to 93. The smoke of the burning seeds was inhaled by the ancients to cure toothache. (Scrib. Comp. 54.) Suffire autem oportet ore aperto alterci semine carbonibus asperso, subinde os colluere aqua calida, interdum enim quasi vermiculi quidam ejiciuntur. (See *Solanum xanthocarpum*.)

The officinal Henbane of the ancients is generally considered to have been *H. albus*, Linn., and in the Mufaridát-i-Násari the seeds are described as Bazr-el-banj-abiad, "seeds of white henbane." Pliny mentions four kinds of the plant; the first with a black seed, flowers bordering on purple, and a prickly stem, growing in Galatia (*H. reticulatus*); the second, or common kind (*H. niger*); the third having seeds like *Irio*, *i. e.* "reddish" (*H. aureus*, Linn.); and the fourth with white seeds, which is preferred by medical men (*H. albus*). All of them have, he says, the effect of producing vertigo and insanity. The Henbane seeds brought from Khorasán are those of *H. reticulatus*. This plant has also been sent to us from Quetta, where it grows abundantly. *H. niger* is cultivated at the Saharanpur Botanic Gardens, where the extract is also manufactured for use in the State Sanitary Establishments. The physiological effects of Hyoscyamus are the same as those of Belladonna, which have already been described. In certain conditions of the system the action of the drug, and especially of hyoscyamine, appears to be considerably modified, as will be seen from the following cases quoted by Stillé and Maisch. "Dr. H. A. Hutchinson, of Pittsburg, took ¼ grain of Merck's hyoscyamine (*Phila. Med. Times*, xiii. 139.) Besides the dryness of the mouth and throat, there was intense congestion of the head and face and violent throbbing of the heart and carotids, numbness over the whole body and muscular incoördination, and an inability to walk without watching the steps. There was no mental excitement or sensory illusion, but an over-powering tendency to sleep, which came on and lasted for 11 hours. Various means were used by friends who were ignorant of the cause of the sopor to arouse the sleeper, but uselessly. During the sleep the muscular system was completely relaxed, and the pulse at first was full and hard, 138 a minute, the respirations 34 to 40, and the temperature 106° F. As the narcotism subsided these rates subsided rapidly toward the normal standards. On regaining consciousness the mind was unsteady and confused, and all objects looked tinged with yellow. During the sleep there was more or less nausea, and once vomiting. No recollection of anything after the commencement of sleep remained. For several days the pupils remained dilated, and there was double vision, while all the secretions, including the perspiration, were suspended. A patient of Empi's affected with paralysis agitans took 5 mgm. of hyoscyamine (gr. $\frac{1}{12}$), and, finding the tremor diminished, used a like quantity on the following day. The first dose caused a slight intoxication, and after the second there was a like confusion of the mind and senses, the face was flushed, the expression anxious, the whole interior of the mouth dry, the tongue stiff, and nausea was experienced. Hallucinations in which rats and serpents appeared, and familiar persons were not recognized, were accompanied and followed by furious delirium, tetanic spasms, and extreme dilatation of the pupils. Deglutition was impossible; the respiration was hurried and oppressed, the pulse at 96; and constant vesical tenesmus existed. The attack lasted for 3 hours, and gradually subsided, and on the morrow only some recollection of the hallucinations remained. (*Bull. de thérap.*, xcix. 378.) A phthisical patient accustomed to hypodermic injections of morphia was given $\frac{1}{40}$ grain of hyoscyamine. After vomiting he became delirious, lost all correct perception of the distance of objects, and constantly caught at insects, with which he said his bed-clothes were covered. (*Practitioner*, xxii. 369.) In some forms of hypochondriasis hyoscyamine seems to have been useful as a means of calming agitation. Prolonged experience has confirmed these statements. Prideaux states (*Practitioner*, xxiii. 446) that it produces sleep, sometimes of considerable duration, in excited conditions of the brain, as in mania, delirium tremens, meningitis, and where ordinary

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hypnotics, and especially opiates, are inadmissible. In such cases small doses ($\frac{1}{16}$ gr.) suffice, but in chronic mania large doses ($\frac{1}{2}$ grain, or even 1 grain) are necessary, and are very useful in cutting short exhibitions of temper and excitement of a violent and destructive character. It would appear to be particularly useful in delusional insanity; the illusions which it conjures up overlie and gradually obliterate those which belong to the disease. In chronic dementia, associated with destructive tendencies, bad habits, and sleeplessness, the patients are much improved by a course of small doses of the drug. (*Stillé and Maisch.*) Of late years the hydrochlorate of hyoscine has been recommended as calmant in maniacal excitement in doses of one-half to one milligram. It is claimed for it that there are no injurious after-effects, and that it is a good hypnotic, but at the same time its depressing influence on the system is admitted, and it appears to have been of no use in a considerable proportion of the cases in which it was tried. There can be no doubt that much of the discrepancy which is observable in the records of the medicinal effects of hyoscyamine, is due to the use of impure or inert samples of the alkaloid.

Description.—The bazar seed is reniform, laterally compressed, equal in size to that of *H. niger*, of a greyish-brown colour. The testa is finely reticulated. The albumen is oily. The embryo curved like the figure 9, the tail of the 9 being represented by the radicle. The taste is oily, bitter and acrid.

Microscopic structure.—The outer envelope of the seed is composed of a row of large cells, the outer walls of which are thin but the lateral and interior very much thickened. The second layer is made up of very small cells tangentially extended and closely applied to one another. The cells of the albumen are polyhedral, and contain granular matter and oil globules.

Chemical composition.—Henbane contains *Hyoscyamine*, $C^{17}H^{23}NO^{3}$, an isomeride of atropine. It occurs both in the seeds and in the juice of the different species of Hyoscyamus, and is accompanied by *Hyoscine* or amorphous hyoscyamine.

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It crystallizes in needles (from dilute alcohol), or prisms (from $CHCl^3$), is more soluble in water and dilute alcohol than atropine, and is lævorotatory, $[\alpha]_D = -21°$. It enlarges the pupil of the eye in the same manner as atropine.

Hyoscyamine occurs mixed with atropine in several plants of the Solanaceæ, such as Datura, Duboisia, Atropa, and probably in some others. Ladenburg is of opinion that atropine is an optically inactive base standing to hyoscyamine in the relation of racemic acid to lævotartaric acid. From 20 grams of commercially pure atropine aurochloride he isolated by recrystallization one gram of hyoscyamine aurochloride, and to this he attributes the statement that atropine can be converted into hyoscyamine. Hyoscyamine is converted into atropine by heating it for 5 or 6 hours above its melting point. Its optical activity may likewise be diminished by allowing its alcoholic solution to stand in the cold after a slight addition of one of the following bases: $NaOH$, KOH, NH^3, NMe^2H, and NMe^4OH, but cannot be reduced below $[\alpha]_D = -1{\cdot}89°$ by this method; so that if Ladenburg is correct in holding atropine to be optically inactive, the conversion of hyoscyamine into atropine is incomplete. Hyoscyamine is split up by boiling dilute HCl or baryta water into the same products as atropine, *viz.*, tropine and tropic acid.

Hyoscine or amorphous hyoscyamine $C^{17}H^{23}NO^3$, is a colourless syrupy fluid, and occurs in the mother-liquor from which hyoscyamine has crystallized. It closely resembles hyoscyamine, both in its mydriatic action on the pupil and in other respects. Boiled with water it splits up into tropic acid and pseudo-tropine. (*Watt's Dict. of Chem*, 2d. Ed. II., 744.)

Henbane seeds contain 26 per cent. of fatty oil, and according to Warnecke yield 4·51 per cent. of ash.

Toxicology.—No clearly authenticated cases of poisoning by Hyoscyamus appear to have been recorded in India, but its use has occasionally been suspected in the Punjab and Beluchistan, where *H. muticus* is common. Under the name of *Kohi-bhang*, "hill bhang," its intoxicating properties are well known to the natives, and it is stated to be smoked like Ganja, and sometimes used in the same way as Datura to facilitate robbery.

NICOTIANA TABACUM, *Linn.*

Fig.—*Lam. Ill. t.* 113; *Wight Ill. t.* 166; *Bentl. and Trim. t.* 191. Tobacco (*Eng.*), Tabac (*Fr.*).

Hab.—America. Cultivated throughout India. The herb.

Vernacular.—Tambákú (*Hind.*, *Mar.*), Támáku (*Beng.*), Pugai-ilai (*Tam.*), Pogáku, Dhúmra-patramu (*Tel.*), Pukayila, Pokala (*Mal.*), Hogesappu (*Can.*), Tamakú (*Guz.*).

History, Uses, &c.—In the Encyclopædia of Sanskrit learning by Rája Rádhákánta Deva, entitled Sabdakalpadruma, tobacco is mentioned under the name of Támrakúta. This name occurs in the Kulárnava-tantra as that of one of eight intoxicating agents. No Sanskrit medical writers mention Tobacco. Támrakúta is a word compounded of Támra, "a red or copper colour," and kúta, "deceitful or vile," and the Hindi name Tambáku may possibly be derived from it and not from the Portuguese, in which case Tobacco has usurped the place of some older but now forgotten drug. From the *Maásir-i-rahimi* and the *Dára-shikohi* we learn that tobacco was introduced into the Deccan by the Portuguese about A. H. 914 (A. D. 1508), and that it began to be smoked about 1605, towards the end of the reign of Sultán Jaláleddeen Akbar. Rumphius speaks of it as having been known from a remote period in the East, and it appears to have been introduced into China in the 16th century probably by way of Japan or Manila. In Europe the Spaniards first became acquainted with Tobacco on the discovery of Cuba in 1492, and introduced it into Spain as a valuable medicinal herb. Gonzalo Fernandez de Oviedo y Valdés, governor of Domingo, in his *Historia general de las Indias*, printed at Seville in 1535, states that the plant is smoked by the Indians through a branched tube of the shape of the letter Y, which they call *Tabaco*.

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In the edition of 1570 of Estienne and Liebaut's *L'Agriculture et Maison Rustique*, Nicot's own account of the herb, which was called after him *Nicotiane*, is given. In it he relates the wonderful cures which were effected by it at Lisbebron (Lisbon), where he was resident as French ambassador to the Court of Portugal in 1559-60 and 61. Nicholas Monardes in 1517 published a full account of the uses of Tabaco, the proper name of which amongst the Indians he says, is *Picielt*; and in 1577 "*Joyfull newes oute of the newe founde worlde*," by John Frampton, appeared, in which the Spanish and French accounts of the plant are reproduced in English. Frampton describes himself as a retired Spanish merchant. Tobacco was first brought to England by Sir John Hawkins about the year 1565, but was not used for smoking by Englishmen until many years after.

Smoking appears to have been first taught in England under the following circumstances:—

Sir Walter Raleigh's first expedition took possession of Virginia on July 13th, 1584, and after a six weeks' stay in the country, returned home. The next year, a second expedition conveyed out a colony under Master Ralph Lane, which remained in the country from August 17th, 1585, to June 18th, 1586: when Sir Francis Drake with his fleet, returning from his victorious raid in the West Indies, brought home the colony to the number of 103 persons. Among these was the celebrated mathematician, Thomas Hariot, who in his, "*Briefe and true report of the new found land of Virginia, &c.*," London, 1588, describes tobacco, and the adoption of the smoking of it by these Virginian colonists. It would therefore appear that Raleigh himself had nothing to do with the introduction of the weed itself, or of the habit of smoking it. But while Sir Walter introduced neither the herb nor the manner of smoking it, there is a general consent that he principally brought the habit of Tobacco-smoking, or, as it was at first called, Tobacco-drinking, into fashion, and a string of stories of a humorous character are on record which connects his name with it. For these stories

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we must refer the reader to Arber's reprint of King James' famous "*Counterblaste to Tobacco.*"

From George Sandys' travels in 1610 we learn that tobacco smoking was becoming common among the Turks at that date, and that it had been introduced into the country by the English merchants.

Like coffee drinking, the use of tobacco met with much opposition at first, and even at the present day is visited with the severest penalties by the Wahabis. Sandys remarks that tobacco from England would prove a principal commodity in Turkey were it not for the severity of Morat Bassa (Murad Pasha), who commanded a pipe to be thrust through the nose of a Turk who was caught smoking, and that he should be led in derision through the city. The Mahometan law doctors in Arabia and Turkey universally condemned its use, in Persia* and the East they appear to have been less severe. In the former country "to fill a pipe for any one" is a vulgar expression for doing a favour. Mulla Fauki says:—

آن یکی پهلو زنده کانیک بسر قلیان ناز
کرده ام بتنباکوی لطفی که از من نگذری

A Sofi praises tobacco in the following terms:—

آن جوانانیکه تنباکو کشند ∴ اولش الله و آخر هو کشند

"Who drink tobacco; breathe Allah first, then God."

The liberal policy of Akbar probably prevented any persecution in India; in China its use was prohibited by the emperors both of the Ming and Tsing dynasties. In Russia up to the time of Peter the Great snuff-taking was forbidden under the penalty of having the nose cut off.

In England Ben Jonson, in *Every Man in his Humour*, acted on 25th November, 1596, skilfully represented both sides of the controversy in the speeches of Bobadilla and Cob. From this date up to 1604 numerous writers appeared in defence or condemnation of the herb. King James 1st then wrote his well

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* Tobacco was introduced into Persia by the Portuguese in the reign of Shah Abbas the Second.

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known *Counterblaste*, and published a *Commissio pro Tabacco* by which he placed a duty of six shillings and eight pence upon every pound imported into England, in addition to the custom of twopence which was before levied. Offenders against this act were liable to confiscation, fine and corporal punishment.

Even now the controversy is not extinct in England, but Tobacco appears to have the best of it, and in all other countries, except in the Wahabi territory, it reigns supreme. Nának Shah indeed when he established the Sikh religion thought it necessary to forbid the use of something, and selected tobacco as the forbidden article, but, nevertheless, he allowed converts who had been in the habit of using it to continue the practice.

The author of the *Makhzan-el-Adwiya* states that native physicians consider tobacco smoke to be disinfectant, and recommend it for fumigating cholera patients. Taken in various ways it is said to purge the brain and stimulate mental activity. The smoke is calmative in asthma and other chest affections, and prevents costiveness if inhaled fasting. The ashes of the plant made into a paste with oil are a useful application to sores and wounds to prevent bleeding. The water from the *hookah* is diuretic, and the black oil which collects in the pipe stem is used on tents to heal up sinuses, and is dropped into the eye to cure night blindness and purulent conjunctivitis. Mir Muhammad Husain closes his notice of Tobacco by remarking that the better classes of English in India smoke the *hookah*, but in their own country they mostly take snuff, a few chew, and smoke pipes (the author of the *Makhzan* wrote about one hundred and twenty years ago). Ainslie mentions the application of the leaves to the anus to promote the action of the bowels by the natives of Southern India. In the Concan a paste made with snuff, lime and the powdered bark of *Calophyllum inophyllum* is applied in orchitis. Dr. Leith of Bombay was in the habit of applying a poultice of Tobacco leaves to the spine in tetanus with good results. The use of Tobacco is very general amongst the natives of India, even women and young children habitually smoke and chew it. The Gúrákú which is used in the *hookah* is essentially a mixture of Tobacco and Gur (coarse sugar), in

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equal proportions, but the wealthier classes add other ingredients to it.*

Guraku has the appearance of an extract; when used it is broken into fragments which are packed in the *chilam* and covered with a layer of live coals of wood, or rice balls specially prepared for the purpose. In Western India cigarettes rolled in the leaves of *Bauhinia racemosa* or *Diospyros Tupru* are much used. Many among the labouring classes chew Tobacco along with their betel leaves and areca nut. Snuff-taking also is very common in some parts of India.

Physiological effects.—Tobacco acts as a poison upon most insects, but is fed upon with impunity by weevils. In frogs, nicotine, after a period of temporary excitement, causes a tetanic condition; sometimes accompanied by convulsions, and followed by muscular ralaxation. Herbivorous animals are not affected by moderate doses injected into the stomach, but large doses reduce the frequency of the pulsations of the heart, and may prove fatal to them. The carnivora are affected by it in the same way as man. When its fumes are thrown into the lungs of animals, or when its decoction is applied to their skin its poisonous operation is speedily developed. Tobacco first stimulates the spinal cord, giving rise to convulsions and afterwards paralyses it. The convulsions are of spinal origin in the frog, but those which occur before death in mammals are probably asphyxial. (*C. Bernard, C. Rouget, L.-Brunton.*)

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* Apples and *Sumbul*, the root of *Nardostachys Jatamansi*, according to the author of the *Makhzan*, who resided for many years at Murshidabad. Dr. K. L. Dey "*On the Use of Narcotics and Stimulants and their Effect upon the Human Constitution*," Calcutta, 1868, gives the following as the composition of the two kinds of *Guraku* commonly used in Bengal:—1st quality, Mild or Bhalsah—Tobacco leaf powder 72 parts, Powdered scents 16, Treacle 88, Ripe Champa plantains 16, Ripe Jack fruit juice 2, Ripe Pineapple juice 1 part. The ingredients to be thoroughly mixed, and the mixture to be allowed to ferment for 6 months.

2nd quality, Strong or Mitla Kurrah—Tobacco leaf powder 12 parts, Tobacco leaf rib powder 6, Powdered scents 2, Treacle 22, Slaked lime 1 part. The ingredients to be thoroughly mixed; it is then ready for use. The following is the composition of the powdered scents:—Root of *Nardostachys Jatamansi* 5 parts, Cassia bark 10, Juniper berries 2, Sandal wood 2, Leaves of *Artemisia Sieversiana* 5, Bdellium 1, cloves 1, Patchouli 5, Capsules of *Xanthoxylon hastile* 5, Alkekengi 5, Storax 5, Tobacco powder to serve as a vehicle for preserving the scents 49. The ingredients to be thoroughly powdered, mixed and sifted.

On man the minutest doses of nicotine ($\frac{1}{32}$ to $\frac{1}{16}$ grain) occasion a burning sensation in the tongue, a hot, acrid feeling in the fauces, and sense of rawness throughout the œsophagus. Salivation is abundant. Small doses produce a sense of heat in the stomach, chest, and head, and even in the fingers, with some excitement of the nervous system; larger ones cause heaviness, giddiness, torpor, sleepiness, indistinct vision, with sensitiveness of the eye to light, imperfect hearing, laborious and oppressed breathing, and dryness of the throat. In 40 minutes after the larger doses a sense of great debility is perceived, the head droops, the pulse-rate falls, the face grows pale, the features are relaxed, the limbs seem paralyzed, the hands and feet are cold, the coldness advances gradually toward the trunk, and faintness ends in loss of consciousness.

The disorder of the digestive organs manifests itself by eructations, nausea, and even vomiting, the abdomen becomes distended, and an urgent desire is felt to go to stool; wind is discharged and urine voided copiously. The nervous system, after the debilitating influence of the poison has developed itself, shows its condition by muscular spasm, which begins with tremulousness of the extremities, and gradually involves the whole muscular system, including the respiratory muscles, so that the breathing is oppressed, gasping, and incomplete.

This enumeration of effects is sufficient to prove that nicotine acts primarily upon the spinal and sympathetic nervous systems, and not upon the brain. It may cause death by direct paralysis of the heart, or more indirectly by paralysis of the respiratory muscles, producing asphyxia. The blood examined during life of a person under the full influence of tobacco presents a striking disaggregation of the red corpuscles, which are also less regularly circular than natural, and have jagged or crenated edges. As the poisonous operation passes off, however, the

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blood regains its normal characters. The action of tobacco itself is so nearly identical with that of nicotine as to render unnecessary a detailed account of it It, however, is mainly exhibited in muscular relaxation and collapse. In some cases "lethargy" and "insensibility" are mentioned, but the condition is not that of cerebral oppression so much as of cerebral exhaustion. Of other symptoms especially prominent in certain cases of tobacco-poisoning, either caused by a single excessive dose or by inordinate indulgence in smoking or chewing tobacco, may be mentioned: a rapid followed by a very slow pulse, hiccough, and cold perspiration, profuse diuresis, convulsions without loss of consciousness, sometimes cataleptic and sometimes hysterical, and great numbness as well as impaired motor power of the limbs and of the tongue. (*Stillé and Maisch.*)

Tobacco is now hardly ever used medicinally. Formerly it was applied to certian cutaneous eruptions such as scabies, and as a palliative in rheumatism and other painful affections, but its local application, if the skin be broken, is dangerous, and its administration in the form of enema, to induce muscular relaxation or remove worms, has often been followed by alarming symptoms. The value of tobacco smoking as a palliative in the paroxysms of asthma is well established, and in some cases its use appears to affect a permanent cure.

There can be no doubt that the moderate use of tobacco smoking is not injurious to a great many people, but it is equally certain that on some constitutions it produces mischievous effects. For a full account of the injurious action of the excessive use of the herb by smoking, snuffing, or chewing, Stillé's *Therapeutics* may be consulted. He shows that it lessens the natural appetite, more or less impairs digestion, and induces constipation, while it irritates the mouth and throat, rendering it habitually congested and impairing the purity of the voice. It induces a constant sense of uneasiness and nervousness, with epigastric sinking or tension, palpitation ("irritable heart"), hypochondriasis, impaired memory, neuralgia, and frequent urination. Chewing and snuffing tend to

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cause gastralgia, but smoking causes neuralgia of the fifth pair. It renders the vision weak and uncertain, causing objects to appear nebulous, or creates muscæ volitantes and similar subjective perceptions. Analogous derangements of hearing occur, with buzzing, ringing, etc., in the ears, and even hallucinations of this sense. Often there is a feeling of a rush of blood to the head, with vertigo and impairment of attention, so as to prevent continuous mental effort; the mind is also apt to be filled with crude and groundless fancies leading to self-distrust and melancholy. The sleep is frequently restless and disturbed by distressing dreams. It impairs muscular power and co-ordination, probably both by interfering with nutrition and by exhausting nervous force, and usually keeps down the growth of muscle and the deposit of fat. Lauder-Brunton remarks that the effects produced on the system by tobacco smoking may be partly due to nicotine, but are probably rather due to products of its decomposition, such as *pyridine* and *collidine*. In pipe-smoking pyridine preponderates, but when tobacco is smoked in cigars, where there is free access of air, the chief product of the dry distillation undergone by the tobacco is collidine, which is far less active than pyridine, and this may partly account for the fact that many Europeans who have resided for some years in India, are unable to smoke a pipe, but can smoke many times the equivalent of a pipeful of tobacco in the form of cigars with impunity.

In those accustomed to smoke tobacco, it has a soothing effect on the nervous system, but it often acts as a nervous stimulant to mental work; as in reading. In these cases the effect is probably not due to the nicotine itself, but to the stimulus of the smoke on the sensory nerves of the mouth, which reflexly stimulates the vaso-motor centre, and dilates the vessels of the brain; since some people produce the same effect by sucking sweets, or sipping whisky and water.

Description.—Tobacco-leaves are from 6 to 20 inches long, and from 2 to 6 inches broad, oval or ovate-lanceolate, sometimes rather obovate in form, pointed and acute at the

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apex, and with an entire margin. In the fresh state they are rather thick, green, and covered with viscid hairs and with small sessile glands; after drying they are thinner, lighter or darker brown, or mottled with different shades of brown, and friable. The leaves have a thick, prominent midrib, branching under acute angles into lateral veins, which are carved near the margin. The odour of tobacco is peculiar and heavy, and its taste disagreeable, bitter, and acrid.

The variety *rustica*, Linn., is chiefly cultivated in India.

Chemical composition.—Tobacco contains a large amount of salts, consisting of sulphates, nitrates, chlorides, phosphates, and malates of potassium, calcium, ammonium, and nicotine, and yields from 14 to 18·5 per cent. of ash. Larger amounts have been obtained, sometimes as much as 25 to 27 per cent. —a result which is probably due in some cases to dust adhering to the viscid glands, as was suggested by B. F. Creighton (1876). The other constituents of tobacco are albumen, resin extractive, gum, citric acid (*Goupil*), and nicotianin.

Nicotianin was discovered by Hermbstädt on distilling tobacco with water; it separates from the distillate in the form of white oliaceous crystals, which have an odour resembling that of tobacco-smoke and a warm and bitterish aromatic taste. (Posselt and Reimann, 1828.) Landerer (1835) obtained nicotianin from the dried, but not from the fresh leaves. Barral (1845) stated that it contains 7·12 per cent. of nitrogen.

Nicotine or *nicotia* is the poisonous principle of tobacco, and was discovered by Posselt and Reimann (1828). It may be prepared by exhausting bruised tobacco with acidulated water, concentrating the infusion, adding an excess of potassa, and agitating with ether, which dissolves the alkaloid, and on the addition of powdered oxalic acid, nicotine oxalate, which is insoluble in ether, is separated (*Schloesing*): or, the ether is evaporated, the liquid neutralized with oxalic acid, evaporated to dryness, and the residue exhausted with boiling alcohol which dissolves oxalate of nicotine. (*Ortigosa.*) On evaporating the solution to a syrupy consistence and agitating it with potassa and ether, an ethereal liquid is obtained, which on

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fractional distillation yields the alkaloid. This is a colourless oily liquid, having at 15° C. the specific gravity 1·0111, and remaining liquid at —10° C. It has an unpleasant, and when heated a pungent, acrid, tobacco-like odour, a burning taste, and a strongly alkaline reaction. Exposed to air and light, it rapidly acquires a brown colour and is partly converted into a resinous compound. It boils near 250° C., but distils at a lower temperature, always leaving a residue. Its composition is $C^{10}H^{14}N^{2}$. It absorbs water from the air, dissolves readily in water, and is separated from this solution by caustic potassa. Alcohol and ether dissolve it in all proportions, and it yields with acids neutral and acid salts, of which the former crystallize with difficulty, and are mostly soluble in weak alcohol, but insoluble in ether. The alkaloid acquires a wine-red colour with strong sulphuric acid, and on heating the mixture is charred. Chlorine gas colours it deep-red or red-brown. When heated with a little hydrochloric acid a violet colour is produced, which on the further addition of nitric acid changes to yellowish-red. The double salts with mercuric and platinic chloride are sparingly soluble in cold water. Dried tobacco leaves contain from 2 to 8, and occasionally as high as 11 per cent. of nicotine. The alkaloid is present in all parts of the green plant, as well as in the dried leaves, and, according to Kissling (1882), also in tobacco-smoke. Instead of nicotine, H. Vohl and H. Eulenburg (1871), found chiefly *collidine*, with *pyridine*, *picoline*, and other bases of the same series in tobacco smoke, besides ammonia and traces of ethylamine; and, in passing the vapours through potassa solution, hydrocyanic, hydrosulphuric, acetic, formic, butyric, valerianic, carbolic, and probably other acids were retained. (*Stillé and Maisch.*)

According to Herr Dieser (*Archiv.* Mar. 31, 1889, p. 266) the acid tartrate of nicotine can be obtained as a well crystallized and definite salt. He prepares it by adding to pure nicotine a hot concentrated filtered alcoholic solution of tartaric acid, when the acid tartrate separates as a white syrup. After cooling, more of the tartaric acid solution is added, so long as it con-

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times to produce a milky separation, and then the last trace of the salt remaining dissolved in the alcoholic liquor is precipitated by the addition of ether. The precipitate is dissolved in hot alcohol, the solution filtered, and ether added to promote the separation of the salt, when it is obtained in handsome crystalline tufts. Analysis of the salt indicated the formula $C^{10}H^{14}N^{2}(C^{4}H^{6})^{2}+2H^{2}O$; it therefore contains 32 per cent. of nicotine.

M. de Coninck (1889) made the interesting observation that in the oxidation of a ptomaine having the formula $C^{8}H^{11}N$ by means of a solution of potassium permanganate a pyridincarboxylic acid was obtained presenting the principal characters of nicotinic acid. Having since obtained the compound in a purer condition he is able now to state definitely (*Compt. Rend.*, cviii., 809) that this acid produced in the oxidation of a ptomaine is identical with nicotinic acid resulting from the oxidation of nicotine. (*Pharm. Jour., June* 8, 1889.)

Prof. E. Schmidt and Mr. Schütte (*Apoth. Ztg.* 1890, 511) have discovered traces of mydriatic alkaloids in tobacco.

Toxicology.—The reports of the Chemical Examiners in India do not contain many cases of poisoning by this drug. Dr. Brown, *Punjab Poisons,* refers to a case of an infant, taken from its mother in the morning, and returned at night but soon died. Portions of tobacco were found in the stomach. In a second case, also reported by Dr. Brown, a female child of a woman who had left her husband was found dead; the stomach contained a quantity of green substance which proved to be portions of tobacco leaves; the brain and lungs were congested. In the Bengal Chemical Examiner's Report for 1884, tobacco was received in connection with three cases of alleged attempts at poisoning, in two of the cases *ganja* was mixed with the tobacco. In the Bombay Dispensary Reports (vol. ii., p. 4,) the injurious effects of tobacco as an emetic in a case of poisoning by opium is recorded. Dr. Lyon (*Med. Jurisprudence for India,* p. 291,) remarks :—"Death has resulted from swallowing tobacco, from administration of a

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decoction of tobacco as an enema, and from swallowing tobacco juice such as collects in pipes; and bad symptoms have been caused by the application of tobacco leaves to a wound, and even to the sound skin. Death has occurred from excessive smoking; it is doubtful, however, whether tobacco smoke contains nicotine; probably its poisonous effects are due to pyridine bases, developed during the combustion of the tobacco.

Commerce.—The average annual total exports of tobacco from India amount to 40 millions of pounds, valued at 11¼ lakhs of Rupees. It is exported from Bombay to Aden, Arabia, and the East Coast of Africa. Of manufactured tobacco the exports average 80,000 lbs., valued at about 24,000 Rupees; three-fourths of this quantity goes to Aden, and the remainder is distributed among twenty-eight different countries, and probably consists of small consignments of Indian cigars for the use of those who have acquired a taste for them in this country.

The annual production of tobacco in all countries has been estimated at about 3,000,000 tons. In former days the tobacco grown at Bhilsa in the Deccan was greatly esteemed, and it seems probable that tobacco was first cultivated in India at that place.

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